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Technical Note N-620

AIRFIELD PAVEMENT EVALUATION - USMCAS YUMA, ARIZONA

BY

R. J. Lowe and W. R. Chamberlin

June 1964

U. S. NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

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AIRFIELD PAVEMENT EVALUATION - USMCAS YUMA, ARIZONA

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ABSTRACT

The evaluation of the U. S. Marine Corps Air Station, Yuma, Arizona, is presented with the allowable gross load capacities of the runways, taxiways, and parking aprons for single, dual, and dual tandem wheel assembly aircraft as computed from the evaluation tests. Information is also included on the construction history, climatic data, and current aircraft traffic. Results of field and laboratory tests on the pavement and subsurface materials are included in the tables. The results of the evaluation show that only the old portion of the operations parking apron is being overloaded by military aircraft at the air station.

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INTRODUCTION

The purpose of the airfield pavement evaluation task is to determine the suitability of the pavement at the various Naval and Marine Corps air stations under the cognizance of the Bureau of Yards and Docks to accommodate the aircraft currently using the station and provide the designers with information on the physical properties of the pavement and pavement materials.

During the period from 13 January to 6 April 1964, field tests were conducted at the U. S. Marine Corps Air Station, Yuma, Arizona, to thoroughly evaluate the pavement used by aircraft at that station. Authority for this evaluation was granted U. S. Naval Civil Engineering Laboratory by the Bureau of Yards and Docks in April 1963. The evaluation consisted of surface plate loading tests on the asphaltic concrete pavements, sampling of the pavements, removal of the pavements, in-place testing of the base, subbase, and subgrade materials, and plate testing on the subgrade. Pertinent data relating to previous testing of the pavements, construction history, rainfall, and current traffic data are contained herein.

BACKGROUND

U. S. Marine Corps Air Station, Yuma, is located in Yuma County, 4 miles south and 1 mile east of Yuma, Arizona. The station is located south of and adjacent to U. S. Highway 80. An aerial photograph of the air station is shown in Figure 1. The airfield, formerly Yuma County Airport, still provides service to the county as its only commercial facility. One commercial airline has numerous flights in and out of the airfield each day.

The field has two major and two auxiliary runways. The two major runways, 03R-21L and 03L-21R, are respectively 9600 feet and 13,300 feet long. The auxiliary runways, 08-26 and 17-35, are at right angles to each other and are used principally by the commercial airlines except during unusual wind conditions when it is necessary for military aircraft to use runway 17-35. Runway 08-26 is 6200 feet long and lies in a generally east--west direction parallel to U. S. Highway 80. Runway 17-35 is 5700 feet long.

The air station covers nearly 4 square miles of desert alluvial plain which slopes gently southwestward in the vicinity of the base. The plain, which is known as the Yuma Desert, was formed from disintegrated rock debris washed out from the mountains in the east and include several hundred square miles between Yuma and the Mexican border.

The desert plain in the vicinity of the base has no natural drainage pattern. Ground water occurs at shallow depths in the flood plain of the nearby Colorado and Gila Rivers in the vicinity of Yuma and at depths of 80 to 100 feet in the alluvium underlying the adjoining portion of the desert plain surrounding the base. It is presumed that the ground water at the base is replenished by infiltration from the north, that is, from beneath the Gila River flood plain, and doubtless moves southwestward to the flood plain at the Colorado River south of Yuma. Water supply wells drilled on the air station showed static levels of approximately 100 feet deep when drilled.

CONSTRUCTION HISTORY

Original construction of the air station occurred during the period from 1941 to 1944. Information extracted from references (1) through (4) indicate that the three asphaltic concrete runways were built during the above period, and a new concrete runway and taxiway were constructed in 1960. Extensions to Runway 03R-21L were added in 1954 and 1955. The northeasterly end of the aircraft parking apron was replaced during 1963. A history of construction based on information available to the Laboratory is presented in Appendix A.

CURRENT AIRCRAFT TRAFFIC

A complete breakdown of the number of landings, takeoffs, and touch and go usage of individual runways at the airfield was not obtainable. Total usage for a 12-month period is shown in Table I.

The primary mission of the air station is training; therefore, all types of aircraft operated by the U. S. Marine Corps are stationed temporarily at Yuma from time to time. During the period of evaluation, the following aircraft were observed operating on the station: A4D, F8U, KC130, T38, T33, S-2, C-1, CH-37, CH-34, and occasionally an F4B. The commercial airline operating at Yuma operates F-27 aircraft. Many types of smaller planes and privately-owned converted B-26 aircraft operate out of the Yuma County Airport.

CLIMATIC DATA

The climate of Yuma is definitely of a desert origin. Indoor heating is necessary from late October until early April, but work can be conducted comfortably out of doors from 10 AM to 5 PM. The winter is generally a period of clear skies and abundant sunshine. The summers are long and hot. Afternoon temperatures reach 100 degrees on the average from June through September. Water content of the air from mid-July to mid-September is higher than might be expected over a desert

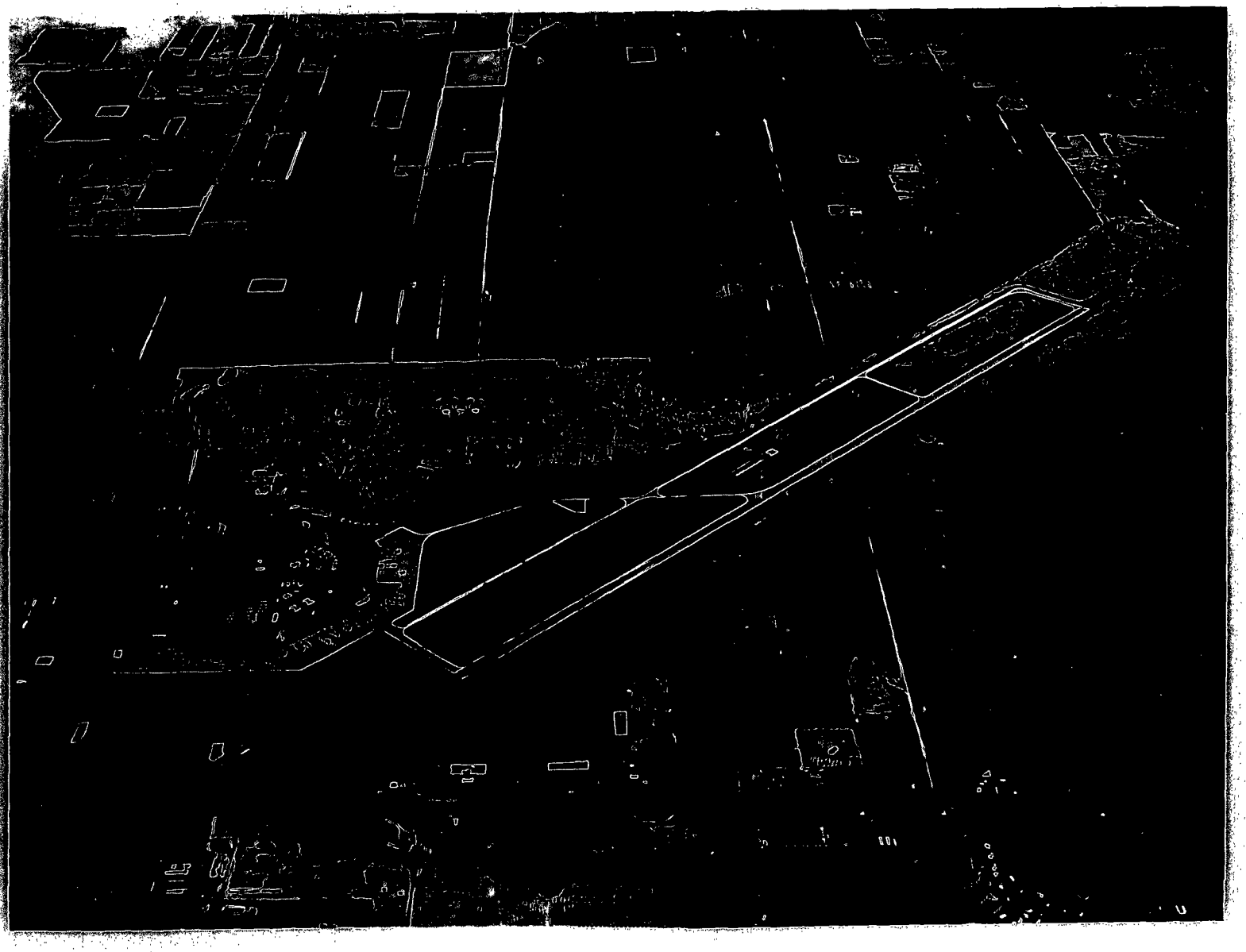


Figure 1. Aerial photograph of the U. S. Marine Corps Air Station, Yuma, Arizona.

Table I. Traffic Data for the U. S. Marine Corps Air Station, Yuma, Arizona

Date	Takeoffs	Landings	Touch & Go
April 1963	3726	3799	2205
May 1963	4066	4102	2461
June 1963	4425	4380	2361
July 1963	4239	4262	2595
August 1963	4696	4674	2158
September 1963	2935	2948	2366
October 1963	4283	4259	3480
November 1963	5609	5619	3366
December 1963	5260	5294	2274
January 1964	5708	5712	3471
February 1964	5301	5323	3128
March 1964	4942	4953	1842
Average monthly operations (based on above 1-year report)	4599	4610	2642

area. This condition is created when the hot desert air balloons upwards, it draws moist-laden air in from the Gulf of Lower California which is relatively near. Evaporative coolers are very effective for cooling purposes during all the months except July, August, and September during which months the wet-bulb temperatures are frequently between 75 and 80 degrees, a condition that makes the ordinary water cooler somewhat ineffective. Yearly rainfall totals are very small. Average monthly temperatures and monthly precipitation data are presented in Appendix B for a few years picked at random. The record means are also shown in Appendix B.

CONDITION OF EXISTING PAVEMENT

A visual inspection of the airfield pavement during the period of evaluation indicated that the general condition of the asphaltic concrete pavement was from poor to fair. Considerable longitudinal and transverse cracking was apparent in the majority of the asphaltic concrete surface. Even where pavement conditions were poor however, no completely failed areas were noted.

The new portland cement concrete runway and adjoining taxiway were in excellent condition. Some spalling at construction joints was noted on both the runway and taxiway, but these spalled areas had been carefully repaired. The east end of the concrete parking apron has been recently replaced and is in excellent condition. The remainder of the parking apron is in from poor to fair condition. It is badly cracked in some areas, and in others there is vertical displacement at the joints.

The general visual condition survey of the pavements is presented in Appendix C. Photographs showing typical pavement conditions noted during the evaluation can be seen in Figures 2 through 8.

Field Investigation

Field investigation consisted of surface plate loading tests on the asphaltic concrete pavements, obtaining cores from both asphaltic concrete and portland cement concrete pavements, sampling of the pavements for subsequent laboratory testing, digging of test pits to determine in-place density and moisture contents of the base, subbase, and subgrade, obtaining of samples of the base, subbase, and subgrade materials for laboratory testing, plate load testing of the subgrade, and augering to a depth of 5 feet to visually classify the subgrade materials to this depth. In general, field tests were spaced on 1000-foot centers on runways and taxiways and one test per 20,000 square yards of aprons. Test locations in a typical plate loading test layout are shown in Figure 9.

Figure 2. General area of Runway 03R-21L showing cracks and pavement condition. USMCAS Yuma, Arizona.

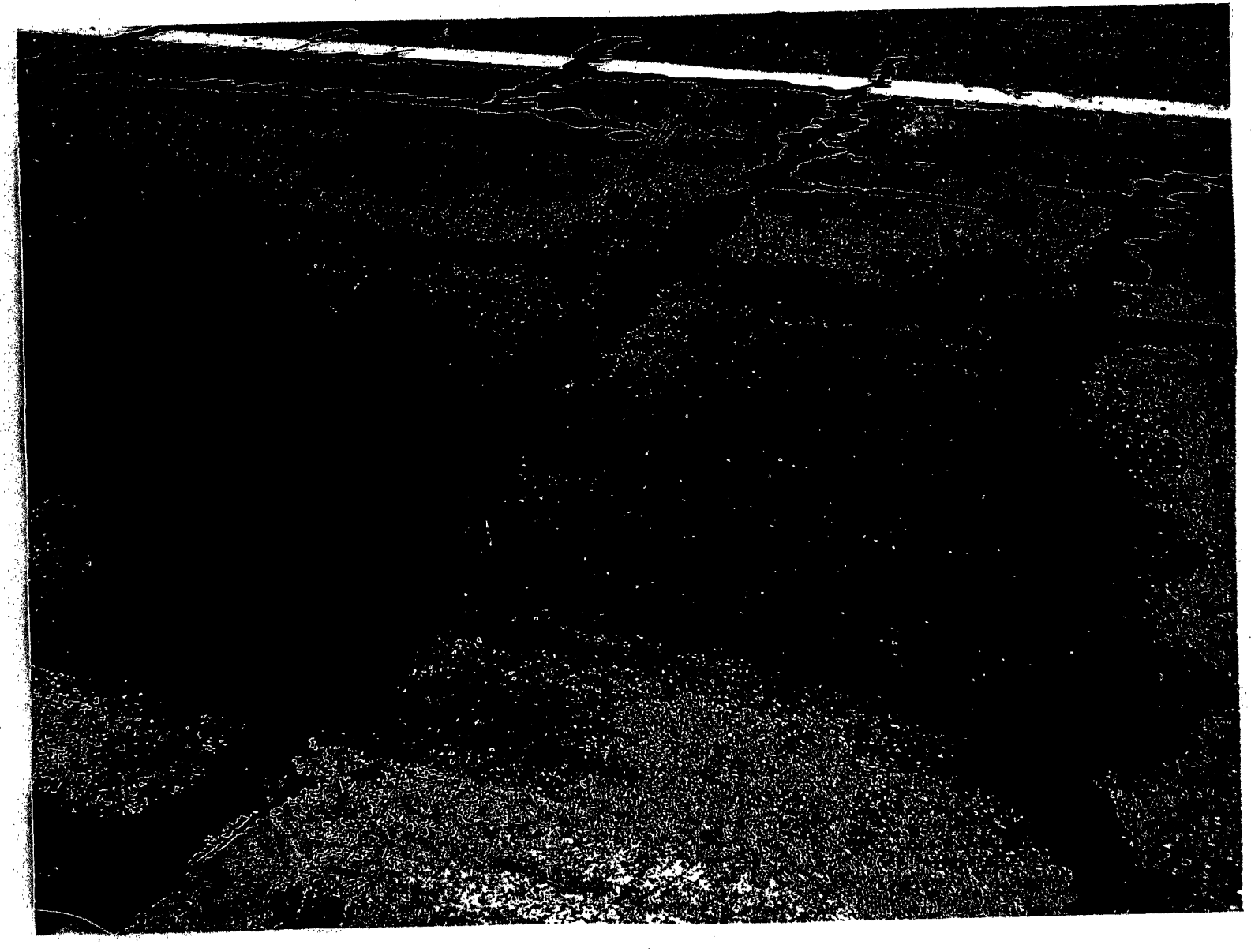


Figure 3. Typical crack condition of Runway 03R-21L, USMCAS Yuma, Arizona.

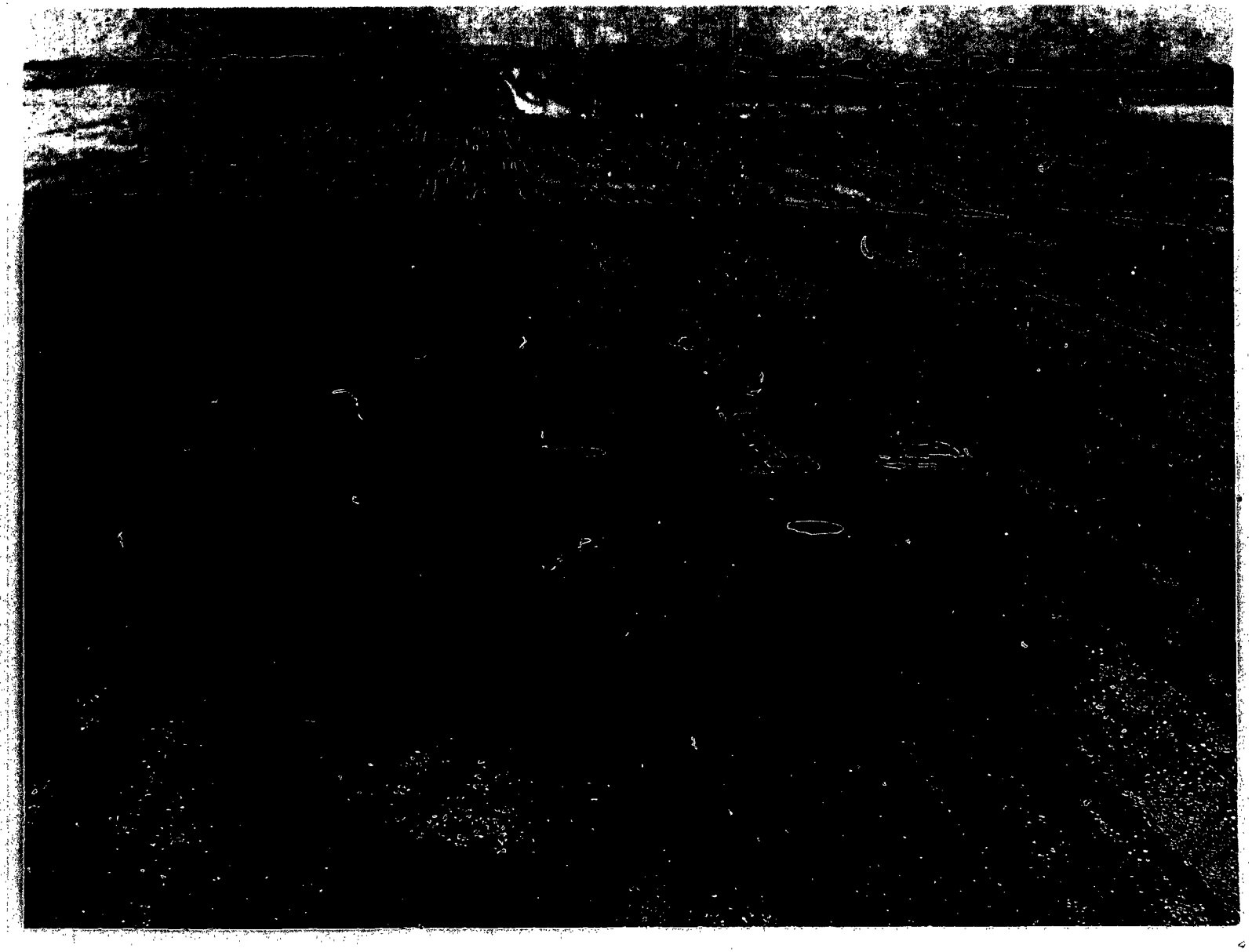


Figure 4. Area of Runway 03R-21L showing effect of jet blast on surface, USMCAS Yuma, Arizona.

Figure 5. General area of Runway 08-26 showing cracks and typical pavement condition, USMCAS Yuma, Arizona.

Figure 6. Typical crack condition of Runway 08-26, USMCAS Yuma, Arizona.

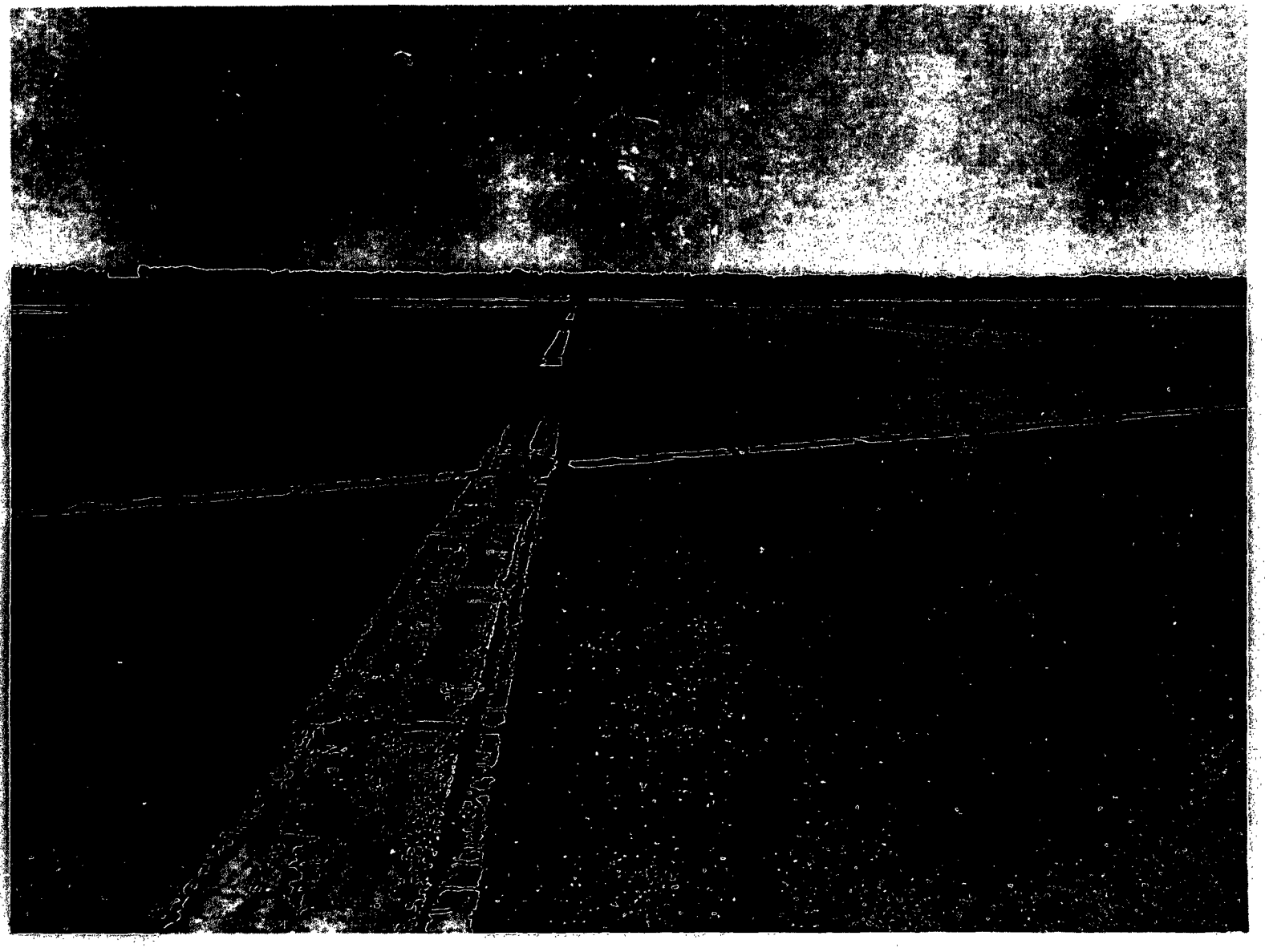


Figure 7. Typical area of Runway 17-35 showing 2-inch wide cracks, USMCAS Yuma, Arizona.

Figure 8. Intersection of Runways 17-35 and 03R-21L showing wide open cracks, USMCAS Yuma, Ariz.

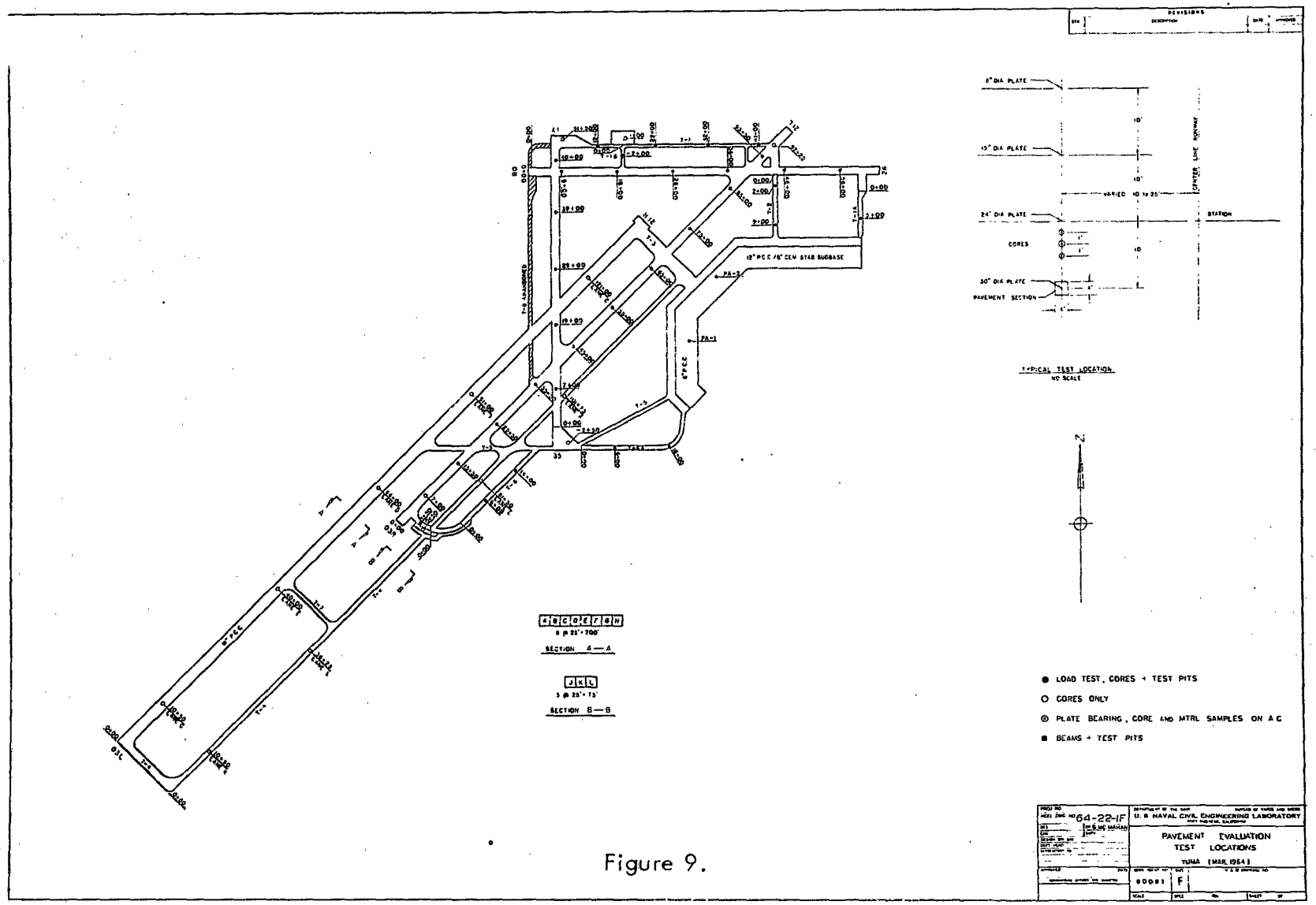

REVISIONS
DESCRIPTION
DATE
APPROVED
8" DIA PLATE
15" DIA PLATE
24" DIA PLATE
CORES
30" DIA PLATE
PAVEMENT SECTION
VARIED 10 to 25'
CENTER LINE RUNWAY
STATION
TYPICAL TEST LOCATION
NO SCALE
12" P.C.C. /6" CEM STAB SUBBASE
6" P.C.C.
PA-1
PA-2
A B C D E F G H
8 @ 25' = 200'
SECTION A — A
J K L
3 @ 25' = 75'
SECTION B — B
LOAD TEST, CORES + TEST PITS
CORES ONLY
PLATE BEARING, CORE AND MTRL SAMPLES ON A C
BEAMS + TEST PITS
64-22-1F
U. S. NAVAL CIVIL ENGINEERING LABORATORY
PAVEMENT EVALUATION
TEST LOCATIONS
YUMA (MAR. 1964)
80081
F

Figure 9.

At each location on the asphaltic concrete pavements, a series of plate loading tests were performed on the surface using 8, 15, 24, and 30-inch-diameter plates in a pattern as shown on Figure 9. During the plate load tests, load was applied in increments to each plate until a total deflection of 0.20 inch was obtained or the capacity of the load cart (100,000 pounds) was reached. In accordance with ASTM D1195-57 procedure, each load increment was maintained until the deflection did not exceed 0.001 inch per minute for 3 successive minutes before the next load was applied. In addition to the plate loading tests, three 3-inch-diameter cores were obtained, and a 4- by 4-foot test pit was dug to perform tests on the underlying materials. Upon removal of the asphaltic concrete pavement, in-place density and moisture tests were run on the base course, and a 75-pound sample of the base material was obtained for laboratory testing. The test pit was then dug to the top of the subbase (if one was present) and then to the subgrade, and with the same procedure being followed on each layer. On the surface of the subgrade, a plate loading test was performed using a 30-inch-diameter plate. Upon completion of the plate bearing tests, an auger hole was drilled to a depth of 5 feet to visually classify the subgrade materials.

At each test location on the portland cement concrete pavements, three 6-inch-diameter cores were obtained. In addition, on the old portion of the operations parking apron two 4-foot square concrete slabs were obtained for subsequent flexural beam testing. At these two locations, subsurface testing was performed in the same manner as under the asphaltic concrete pavements.

At the USMCAS Yuma, a total of 142 surface plate loading tests and 36 subgrade plate tests were performed, 102 3-inch-diameter asphaltic concrete cores, 51 6-inch-diameter portland cement concrete cores, 36 test pits, 67 in-place densities, 67 soil samples, 34 12- by 12-inch asphaltic concrete pavement sections, and two 4- by 4-foot portland cement concrete pavement sections were obtained.

LABORATORY TESTING

In the laboratory the following determinations were made of the properties of the materials obtained in the field:

Asphaltic concrete

thickness	
bulk specific gravity	ASTM-D1075-54 (section 4)
strength of cores (unconfined compression)	ASTM-D1074-60

extraction of asphalt	ASTM-D762-49
percent of asphalt	
percent voids - total mix	
percent asphalt - total mix	
penetration of asphalt @ 77°F	ASTM-D5-61
ductility of asphalt @ 77°F	ASTM-D113-44
ductility of asphalt @ 45°F	Doyle-HRB Record #24
gradation of aggregates	ASTM-C136-61T
specific gravity of aggregates	Using Model 930 Beckman air comparison pycnometer

Portland cement concrete

thickness	
examine for deficiencies	
tensile splitting test	Thaulow, June 1957, Journal, American Concrete Institute
modulus of rupture	ASTM C42-61

Subsurface Materials

gradation of aggregates	ASTM C136-61T
specific gravity of aggregates	Using Model 930 Beckman air comparison pycnometer
plastic limit and plasticity index of soils	ASTM D424-59
moisture-density relation of soils	ASTM D1557-58T
California bearing ratio	EM 1110-45-302 (CE)

All of the above tests are specified in NAVDOCKS DM-21 and were performed in accordance with procedures listed above.

TEST RESULTS

Asphaltic Concrete Pavements

The results of the plate loading tests conducted on the surface of the asphaltic concrete pavements are presented in Appendix D. The loads causing 0.15 inch deflections on the 8-inch and 30-inch plate tests were

used for computing the allowable gross aircraft loads for the asphaltic concrete pavements in accordance with Figure 13-1 of NAVDOCKS DM-21. The graphic method for determining these allowable gross aircraft loads for tire pressures of 150 and 400 psi are presented in Appendix E for each of the asphaltic concrete pavements. A summary of the pavement load ratings as obtained from the curves in Appendix E are shown in Table II.

Results of the laboratory tests performed on the asphaltic concrete cores and the recovered asphaltic concrete pavement sections are shown in Table III. Gradations of the recovered aggregates are presented in Appendix F.

Portland Cement Concrete Pavements

Tensile splitting tests were performed on all concrete cores obtained from the portland cement concrete pavements. Flexural strength test beams were cut from the two pavement sections obtained from the Operations parking apron and were tested in the laboratory to determine the modulus of rupture of the in-place concrete. The results of the tensile splitting tests and the modulus of rupture obtained from the field-cut beams and from 60-day strengths of field control beams made at the time Runway 03L-21R and Taxiway 4 were constructed (in 1960) are presented in Table V. Using these data a ratio of flexural strength to tensile splitting strength at each location was developed, and an average ratio of 1.29 was determined. Using this average ratio, flexural strengths were computed, and concrete working strengths for the concrete in place were computed as shown also in Table V. With these data and the modulus of subgrade reaction, "K", for the various pavements, as obtained from this evaluation or previous evaluations, the allowable load rating for the portland cement concrete pavements were computed in accordance with example 13-1 of NAVDOCKS DM-21. The load ratings for the portland cement concrete pavements are shown in Table VI.

Subsurface Materials

Gradations of the base, subbase, and subgrade materials are presented in Appendix F. Results of the 30-inch-diameter plate loading tests performed on the subgrade and the calculated modulus of subgrade reaction, "K", are presented in Appendix G. "K", the modulus of subgrade reaction, is also tabulated in Tables IV and VI. Results of the laboratory tests performed on the base, subbase, and subgrade materials are shown in Table IV. Typical curves for moisture-density relationship and California bearing ratio for a sample of the base and the subgrade are presented in Appendix H. Logs of each of the test pits including the auger hole log are presented in Appendix I.

Table II. Load Ratings for Asphaltic Concrete Pavements, USMCAS Yuma, Arizona

	Allowable Gross Aircraft Loads (lbs)			
	Single Wheel Gear		Dual Wheel Gear	Dual Tandem Gear
Location	150 psi Tires	400 psi Tires	150 psi Tires	150 psi Tires
Runways				
03R-21L	266,000	162,000	345,000	518,000
08-26	105,000	63,000	137,000	206,000
17-35	130,000	72,000	171,000	255,000
Taxiways				
1	158,000	101,000	206,000	308,000
1A	152,000	74,000	198,000	295,000
1B	107,000	67,000	139,000	209,000
2	264,000	78,000	344,000	514,000
6	312,000	95,000	400,000	610,000
6A	282,000	175,000	366,000	550,000

Table III. Laboratory Test Results of Asphaltic Concrete Pavement Specimens, USMCAS Yuma, Arizona

Location	Average Thickness of A.C. (inches)	Average Bulk Specific Gravity of Cores	Average Compressive Strength of 3" Dia Cores (p.s.i.)	Percent Asphalt by Weight	Specific Gravity of Aggregate	Penetration at 77° F (0.10 mm.)	Ductility at 77° F (cm.)	Ductility at 45° F (cm.)	Percent Voids Total Mix	Percent Voids Filled with Asphalt Total Mix
Runway 03R-21L										
15+50	4.2	2.36	1054	Surface 6.4	2.72	13	150+	1.0	3.3	81.9
				Binder 5.0	2.71	13	150+	1.0	5.2	69.1
25+50	4.3	2.39	842	Surface 6.9	2.69	15	143	0.6	0.8	95.3
				Binder 5.3	2.70	9	12.9	0.3	9.0	75.6
35+50	11.5	2.33	927	Surface 4.8	2.68	8	5.7	0.0	5.6	66.3
				Binder 6.2	2.68	21	150+	9.7	2.5	85.2
45+00	7.9	2.27	880	Surface 5.9	2.68	8	11.4	0.2	3.8	78.2
				Binder 5.2	2.66	6	1.0	0.2	10.2	52.4
55+00	7.2	2.30	744	Surface 5.0	2.69	6	39.7	0.1	6.4	64.1
				Binder 5.4	2.66	4	5.5	0.0	7.7	62.2
65+00	11.5	2.29	805	Surface 5.9	2.67	10	9.3	0.1	3.7	78.6
				Binder 4.7	2.68	4	1.2	0.1	9.2	55.9
75+00	7.0	2.25	851			NO PAVEMENT SAMPLE				
85+00	9.7	2.28	927	Surface 5.7	2.69	7	10.0	0.2	4.5	75.5
				Binder 5.9	2.66	5	2.0	0.1	10.3	55.0
93+50	5.1	2.30	880	Surface 4.8	2.67	6	12.3	0.4	7.3	59.7
				Binder 5.8	2.71	3	4.5	0.3	7.3	64.1
Runway 08-26										
6+00	3.6	2.25	854	6.7	2.68	4	3.4	0.5	7.8	65.5
16+00	4.3	2.25	784	5.6	2.67	1	UNABLE TO MOLD		5.9	67.8
26+00	4.5	2.26	757	6.7	2.68	6	0.6	0.5	7.4	66.7
36+00	3.5	2.24	739	5.4	2.65		ASPHALT FOAMED		8.2	59.1
46+00	4.1	2.12	FRIABLE	7.1	2.67	2	0.4	0.0	11.7	55.8
56+00	4.5	2.10	477	6.3	2.66	2	0.1	0.0	12.9	50.1
Runway 17-35										
7+00	1.6	2.21	TOO SHORT	6.0	2.67	5	0.3	0.0	9.1	58.8
19+00	3.0	2.29	888	5.3	2.68	5	1.3	0.3	7.3	62.0
29+00	3.5	2.29	861	5.7	2.69	6	1.7	0.2	6.1	67.7
39+00	4.6	2.29	631	5.2	2.69	2	1.2	0.2	7.3	61.6
49+00	3.6	2.33	711	6.1	2.68	5	2.5	0.5	4.5	75.6
Taxiway 1										
12+00	4.2	2.44	291	6.2	2.71	21	5.7	0.5	0.4	97.4
22+00	3.5	2.41	330	6.5	2.70	23	6.1	0.5	1.2	92.9
32+00	3.7	2.38	354	4.7	2.70		ASPHALT FOAMED		5.2	68.3
41+00	3.2	2.22	632	5.0	2.70	5	0.5	0.0	10.8	50.7
Taxiway 1-A										
5+00	3.3	2.33	511	4.5	2.68	16	24.7	0.5	6.8	70.0
Taxiway 1-B	4.2	2.37	473	5.9	2.69	28	16.0	6.5	3.3	80.6
Taxiway 2										
2+00	1.6	2.35	TOO SHORT	5.9	2.70	16	35.4	0.5	4.5	69.7
9+00	1.2	2.33	TOO SHORT	5.8	2.69	19	76.1	5.0	5.3	69.6
Taxiway 6										
1+50 Offset	Surface 2.1	2.33	TOO SHORT	5.4	2.68	18	103	1.5	5.3	71.1
	Binder 3.8	2.40	820	4.7	2.70	19	150+	4.0	4.0	73.4
6+00	Surface 1.5	2.37	TOO SHORT	5.9	2.69	22	150+	6.8	2.9	51.6
	Binder 2.3	2.40	TOO SHORT	6.1	2.72	46	150+	114.0	2.8	83.7
14+00	Surface 1.5	2.44	351	7.0	2.70	34	150+	7.2	3.7	81.2
	Binder 2.5			4.7	2.70	39	150+	22.5	2.9	79.5
Taxiway 6-A										
6+00	2.6	2.31	1391	5.1	2.67	5	0.8	0.5	6.5	64.0
16+00	3.0	2.33	1217	4.7	2.69	5	1.8	0.0	6.8	61.2

Table IV. Results of Tests on Base, Subbase, and Subgrade Materials, USMCAS Yuma, Arizona

Location	Maximum Dry Density	Optimum Moisture Content	In-Place Density		In-Place Moisture Content	C.B.R.*	Plasticity Index	Specific Gravity	Subgrade Modulus K in pci
			lbs/cu.ft.	% of max. dry Density					
Taxiway 1									
12+00									
Base	137.8	7.2	132.5	96.2	1.8	80	NP	2.65	
Subgrade	118.5	9.4	119.9	101.2	2.8	76	NP	2.65	680
22+00									
Base	137.8	7.2	124.3	90.3	4.4	50	NP	2.65	
Subgrade	118.5	9.4	119.8	101.0	3.3	78	NP	2.65	710
32+00									
Base	137.8	7.2	127.6	92.6	2.4	60	NP	2.65	
Subgrade	118.5	9.4	114.2	96.5	2.8	42	NP	2.65	490
41+00									
Base	145.3	7.2	129.1	88.9	3.2	81	NP	2.65	
Subbase	142.4	8.2	NO DENSITY TEST			100	NP	2.65	
Subgrade	127.7	9.0	136.5	106.8	2.0	100+	NP	2.65	420
Taxiway 1-A									
5+00									
Base	147.0	6.0	129.2	87.9	3.3	100	NP	2.65	
Subbase	144.8	8.6	134.0	92.5	3.7	100+	NP	2.65	
Subgrade	125.6	9.9	116.5	92.8	6.4	58	NP	2.65	470
Taxiway 2									
2+00									
Base	146.2	8.5	131.1	89.7	3.1	100+	NP	2.64	
Subgrade	126.5	8.0	120.2	95.0	4.7	55	NP	2.65	670
9+00									
Base	136.0	6.0	133.7	98.3	3.6	100+	NP	2.64	
Subgrade	126.5	8.0	130.0	102.8	6.7	75	NP	2.65	730

Table IV. Results of Tests on Base, Subbase, and Subgrade Materials, USMCAS Yuma, Arizona (Continued)

Location	Maximum Dry Density	Optimum Moisture Content	In-Place Density lbs/cu.ft.	In-Place Density % of max. dry Density	In-Place Moisture Content	C.B.R.*	Plasticity Index	Specific Gravity	Subgrade Modulus K in pci
Taxiway 6									
1+50 (Offset)									
Base	134.8	7.0	138.8	103.0	2.1	100+	NP	2.70	
Subgrade	114.0	8.0	119.0	104.3	6.4	50	NP	2.69	1020
6+00									
Base	141.0	5.0	142.2	100.9	4.7	100+	NP	2.70	
Subbase	142.8	5.0	140.0	98.0	4.8	95	NP	2.69	
Subgrade	114.0	8.0	114.0	100.0	5.2	40	NP	2.69	1220
14+00									
Base	141.0	5.0	138.9	98.5	3.3	100+	NP	2.70	
Subbase	142.8	5.0	138.2	96.8	3.7	90	NP	2.69	
Subgrade	114.0	8.0	115.9	101.7	6.4	42	NP	2.69	730
Taxiway 6-A									
6+00									
Base			CEMENT STABILIZED BASE				NP	----	
Subgrade	134.4	6.2	132.9	98.9	3.4	100+	NP	2.65	640
16+00									
Base			CEMENT STABILIZED BASE				NP	----	
Subgrade	134.4	6.2	142.2	105.8	3.3	100+	NP	2.65	800
Runway 17-35									
7+00									
Base	134.8	5.0	135.1	100.2	3.0	100+	NP	2.66	
Subgrade	118.8	9.0	115.8	97.5	6.8	39	NP	2.63	280
19+00									
Base	134.8	5.0	138.0	102.4	2.8	100+	NP	2.66	
Subgrade	108.2	10.4	107.2	99.1	6.6	23	NP	2.63	440

Table IV. Results of Tests on Base, Subbase, and Subgrade Materials, USMCAS Yuma, Arizona (Continued)

Location	Maximum Dry Density	Optimum Moisture Content	In-Place Density		In-Place Moisture Content	C.B.R.*	Plasticity Index	Specific Gravity	Subgrade Modulus K in pci
			lbs/cu.ft.	% of max. dry Density					
Runway 17-35									
29+00									
Base	138.4	6.2	139.5	100.8	2.6	100+	NP	2.66	
Subgrade	108.2	10.4	103.0	95.3	8.2	17	NP	2.63	590
39+00									
Base	138.4	6.2	138.8	100.1	3.0	100+	NP	2.66	
Subgrade	118.8	9.0	109.3	91.9	8.1	20	NP	2.63	470
49+00									
Base	138.4	6.2	136.2	98.4	3.6	100+	NP	2.66	
Subgrade	118.8	9.0	110.9	93.3	8.8	24	NP	2.63	440
Runway 08-26									
6+00									
Base	139.6	4.9	138.7	99.4	3.7	100+	NP	2.65	
Subgrade	109.7	9.6	110.9	101.1	6.8	40	NP	2.63	270
16+00									
Base	139.6	4.9	138.4	99.1	3.1	100+	NP	2.65	
Subgrade	109.7	9.6	110.5	100.7	5.7	37	NP	2.63	510
26+00									
Base	139.6	4.9	140.5	100.6	3.2	100+	NP	2.65	
Subgrade	126.1	7.6	122.2	96.9	6.8	66	NP	2.63	250
36+00									
Base	135.8	5.5	135.3	99.6	3.2	100+	NP	2.65	
Subgrade	126.1	7.6	114.9	91.1	7.7	25	NP	2.63	200
46+00									
Base	135.8	5.5	133.6	98.4	3.2	100+	NP	2.65	
Subgrade	126.1	7.6	118.0	93.6	7.5	39	NP	2.63	365

Table IV. Results of Tests on Base, Subbase, and Subgrade Materials, USMCAS Yuma, Arizona (Continued)

Location	Maximum Dry Density	Optimum Moisture Content	In-Place Density lbs/cu.ft.	In-Place Density % of max. dry Density	In-Place Moisture Content	C.B.R.*	Plasticity Index	Specific Gravity	Subgrade Modulus K in pci
Runway 08-26									
56+00									
Base	135.8	5.5	131.2	96.6	2.4	100+	NP	2.65	
Subgrade	126.1	7.6	116.6	92.5	4.7	32	NP	2.63	215
Runway 03R-21L									
15+50									
Base	143.3	4.3	139.9	97.5	3.3	82	NP	2.71	
Subgrade	118.9	7.0	118.3	99.5	6.6	30	NP	2.67	1460
25+50									
Base	143.3	4.3	135.9	94.8	3.8	51	NP	2.71	
Subgrade	118.9	7.0	117.0	98.4	4.6	30	NP	2.67	1000
35+50									
Base	138.8	5.3	139.5	100.5	3.0	100+	NP	2.65	
Subgrade	118.9	7.0	115.8	97.5	3.7	29	NP	2.67	1000
45+00									
Base	138.8	5.3	132.9	95.7	2.4	100+	NP	2.65	
Subgrade	112.8	6.0	120.0	106.4	8.7	40+	NP	2.67	590
55+00									
Base	138.8	5.3	142.4	102.7	1.4	100+	NP	2.65	
Subgrade	112.8	6.0	115.2	102.2	4.4	45	NP	2.67	490
65+00									
Base	138.4	5.2	131.9	95.2	2.9	80	NP	2.65	
Subgrade	112.8	6.0	121.9	107.9	5.8	40+	NP	2.67	500
75+00									
Base	138.4	5.2	133.7	96.5	3.2	100+	NP	2.64	
Subgrade	115.6	7.7	121.5	105.1	5.0	40+	NP	2.67	675

Table IV. Results of Tests on Base, Subbase, and Subgrade Materials, USMCAS Yuma, Arizona (Continued)

Location	Maximum Dry Density	Optimum Moisture Content	In-Place Density		In-Place Moisture Content	C.B.R.*	Plasticity Index	Specific Gravity	Subgrade Modulus K in pci
			lbs/cu.ft.	% of max. dry Density					
Runway 03R-21L									
85+00									
Base	138.4	5.2	130.4	94.3	3.6	65	NP	2.64	
Subgrade	115.6	7.7	116.0	100.4	5.8	40+	NP	2.67	780
93+50									
Base	138.4	5.2	134.2	97.0	4.0	100+	NP	2.64	
Subgrade	115.6	7.7	117.3	101.4	1.7	40+	NP	2.67	740
Operations Parking Apron									
PA-1	126.1	7.6	128.4	101.7	8.4	100+	NP	2.65	165
PA-2	126.1	7.6	120.5	95.5	3.6	53	NP	2.67	165

* C.B.R. values were obtained by correlation of in-place densities with laboratory CBR-density studies.

Table V. Results of Tests on Portland Cement Concrete Pavement Specimens, USMCAS Yuma, Arizona

Location	Pavement Thickness (inches) (1)	Field Control Flexural Strength (1960 Data) (2)	Tensile Strength (psi) (3)	Ratio of Flexural Strength to Tensile Strength (2)/(3) (4)	Flexural Strength Based on Average Ratio of 1.29 (psi) ((3)x1.29) (5)	Concrete Working Strength (psi) (5)/1.4
Runway 03L-21R						
10+50 Lane "C"	10.5	783	506	1.55	653	467
40+00 Lane "E"	10.6	766	606	1.26	782	559
66+00 Lane "D"	11.0	675	537	1.26	693	495
91+00 Lane "F"	10.9	660	591	1.12	762	545
121+00 Lane "C"	11.1	737	561	1.31	724	517
Runway 03R-21L						
7+00	14.9	---	632	----	815	582
97+25	11.2	---	604	----	779	556
Runway 17-35						
-2+50	10.2	---	536	----	691	494
51+50	8.4	---	631	----	814	581
Taxiway 4						
10+50 Lane "K"	12.7	652	439	1.48	566	404
36+25 Lane "L"	12.4	650	536	1.21	691	494
81+50 Lane "L"	13.0	744	503	1.48	649	464
101+75 Lane "J"	14.9	670	689**	0.97***	889	635
Taxiway 1 Parking Apron						
1+00	5.7	---	600	----	774	553
Operation Parking Arpon						
PA-1	5.6	420*	386	1.09	498	356
PA-2	5.6	650*	549	1.18	708	506
East End (Built 1963)	12.0	863	---	----	863	616
Taxiway 6 Offset						
0+50	15.0	---	649	----	837	598

AVERAGE = 1.29

* Beams taken from pavements during May 1964 and tested at NCEL.
** Re-bars in break.
*** Not included in average.

Table VI. Load Ratings for Portland Cement Concrete Pavements

Location	Average Concrete Pavement Thickness (inches)	Average Concrete Working Stress (w.s.) (psi)	K Value	Single Wheel Gear Loads (kips) Corrected for K & Working Stress (DM-21 Figures 11-5 & 11-6)		Allowable Gross Aircraft Loads (kips) For Aircraft With (DM-21 Figure 11-5 or 11-6)			
						Single Wheel Gear		Dual Wheel Gear (30" Spacing)	Dual Tan Gear
				150 psi Tires	400 psi Tires	150 psi Tires	400 psi Tires	150 psi Tires	150 ps Tires
Runway 03L-21R	10.8	517	500	62	49	131	103	225	410
Runway 03R-21L (Ends)	13.0	569	200	95	72	200	152	227	460
Runway 17-35 (Ends)	9.3	538	300	45	37	95	78	158	298
Taxiway 4	13.2	499	500	90	72	190	152	317	525
Taxiway 1 Parking Apron	5.7	553	500	22	16	46	34	82	225
Operations Parking Apron (Old Section)	5.6	421	165	13	11	27	23	39	121
Operations Parking Apron (New Section)	12.0	616	500	91	74	192	155	320	535
Taxiway 6 Offset	15.00	598	300	102	80	215	169	353	570

CONCLUSIONS

A review of the calculated allowable gross aircraft loads as shown on Tables II and VI indicated that from a load-carrying standpoint all the pavements used by military aircraft with the exception of the old portion of the operations parking apron are capable of carrying the loads imposed by aircraft in use today at the air station. Visual inspection of the asphaltic concrete pavements showed that all pavements required crack and surface sealing. A review of the laboratory tests conducted on the recovered materials from the asphaltic concrete pavements shows that, with only a few exceptions, the asphalt has become hard (aged) as would be expected. The penetration of the asphalt recovered from the older pavements which was originally 85 to 100 penetration was between 1 and 28 while that from some of the newer pavements was as high as 46. Ductility of the asphalt ranged between 0.1 and 150 centimeters for the older asphalts at 77°F and between 0.0 and 9.7 centimeters at 45°F. In-place moisture content of the subgrade materials was as high as 8.8 percent, and optimum moistures were as high as 10.4 percent. All subsurface materials were found to be non-plastic and had California bearing ratios ranging from a low of 23 to 100+.

RECOMMENDATIONS

It is recommended that frequent condition surveys of the pavements at USMCAS Yuma be conducted. It is further recommended that surface sealing of the asphaltic concrete pavements be considered.

REFERENCES

1. Airfield Pavement Evaluation Report No. 1, Yuma Army Airfield, Yuma, Arizona, February 1944.

2. Airfield Pavement Evaluation Report No. 4, Yuma County Airport, Yuma, Arizona, April 1956.

3. Airfield Pavement Evaluation Report No. 2, Yuma County Airport, Yuma, Arizona, August 1956.

4. Airfield Pavement Evaluation Report No. 3, Vincent Air Force Base, Yuma, Arizona, January 1958.

Appendix A

CONSTRUCTION HISTORY FOR USMCAS YUMA, ARIZONA

Appendix A

CONSTRUCTION HISTORY FOR USMCAS YUMA, ARIZONA

Station	Section from Surface to Subgrade	Date Constructed	Date Strengthened
	Runway 03R-21L		
30+00 to 98+00	5" - 11.5" AC 7 - 14" Base Crusher Run 4 - 6" Compacted Native Material	1941	1952
10+00 to 30+00	4" AC 10" Base Crusher Run 4 - 6" Compacted Native Material	1954	
6+00 10+00	15" PCC 6" Compacted Native Material	1955	
	Runway 17-35		
0+00 52+00	5" AC 8 - 11" Base Crusher Run 4 - 6" Compacted Native Material	1941-42	
	Runway 03L-21R		
0+00 to 133+00	10.8" PCC 6" Cement Stabilized Native Material	1960	
	Runway 08-26		
0+00 63+00	5" AC 7 - 9" Base Crusher Run 4 - 6" Compacted Native Material	1941-42	
	Taxiway 1		
	5" AC 11" Base Crusher Run 4 - 6" Compacted Native Material	1941-42	
	Taxiway 1-A		
	4" AC 14" Base Crusher Run 4 - 6" Compacted Native Material	1941-42	
	Taxiway 2		
	5" AC 7 - 9" Base Crusher Run 6" Compacted Native Material	1944	

Station	Section from Surface to Subgrade	Date Constructed	Date Strengthened
	Taxiway 4		
0+00 to 135+00	13.2" PCC 6" Cement Stabilized Native Material	1960	
	Taxiway 6		
3+50 19+00	4" AC 6" Base Crusher Run 4" Select Material Subbase 6" Compacted Native Material	1954	
-10+00 to 3+50	6" AC 11" Base Crusher Run 4 - 6" Compacted Native Material	1955	
	Taxiway 6-A		
0+00 21+00	3" AC 6" Cement Stabilized Base 6" Compacted Native Material	1944	
	Taxiway 6 - Offset Warm-Up Apron - SW end of 3R-21L		
0+00 to 4+58	15" PCC 6" Compacted Native Material	1955	
	Operations Parking Apron		
Northeast End	12" PCC 6" Cement Stabilized Base 12" Compacted Native Material	1963	
Central and Southerly End	6" PCC	1943	
	Taxiway 1 - Parking Apron		
	6" PCC	1942	

Appendix B

CLIMATOLOGICAL DATA FOR

USMCAS YUMA, ARIZONA

Appendix B

CLIMATOLOGICAL DATA FOR USMCAS YUMA, ARIZONA

Average Temperature

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	An'l.
1941	56.4	62.5	64.8	67.0	80.2	82.6	91.9	87.2	80.8	71.1	65.2	57.7	72.3
1949	46.8	55.2	63.2	74.9	78.4	88.8	93.6	92.8	92.2	73.8	69.8	54.8	73.7
1953	61.5	59.0	65.4	69.9	73.6	85.8	95.2	93.2	88.2	76.4	66.4	55.6	74.2
1960	53.0	58.1	69.8	74.2	79.7	92.3	95.8	94.2	89.8	76.3	64.8	56.1	75.4
1963	53.2	67.5	64.4	68.3	81.2	84.3	93.6	91.7	89.9	79.3	65.4	57.6	74.5
RECORD MEAN TEMP	54.8	58.8	64.2	70.7	77.2	85.3	91.7	91.0	85.5	74.0	62.7	55.8	72.6
MAX	67.2	72.3	78.6	86.4	93.5	102.1	106.2	104.8	100.7	89.2	76.6	68.0	87.1
MIN	42.4	45.2	49.7	54.9	60.8	68.4	77.2	77.1	70.2	58.8	48.8	43.6	58.1

Total Precipitation

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	An'l.
1941	.83	.50	1.54	.28	.00	.00	.17	2.16	.08	.36	.37	.42	6.71
1949	2.83	.02	.04	T	.32	.00	.13	T	T	.35	T	.29	3.98
1953	.01	.10	.18	T	.00	T	T	.02	.00	T	T	T	.31
1960	.74	.07	.03	T	.01	.02	T	.01	.42	T	T	.12	1.42
1963	.50	.13	.16	T	.00	.00	.05	.06	2.47	.92	.19	.00	4.48
RECORD MEAN	.43	.41	.31	.09	.03	.01	.21	.57	.38	.29	.22	.48	3.43

T - Trace

Appendix C

VISUAL PAVEMENT CONDITION SURVEY

USMCAS YUMA, ARIZONA

Appendix C

VISUAL PAVEMENT CONDITION SURVEY, USMCAS YUMA, ARIZONA

Pavement Facility	Type	Stationing	Condition
Runway 03R-21L	Asphaltic concrete	0+00-2+50	Fair - many longitudinal and transverse cracks from 0.5 to 0.75 inch wide - two areas have been patched.
	Portland cement concrete	2+50-11+90	Excellent except for few spalled joints and surface blemishes due to wood chips, etc.
	Asphaltic concrete	11+90-101+00	Poor - few good areas, map and/or open cracks prevail. Several areas have been eroded by jet blast. Some of the cracks are open to 1-inch. Spalling of these cracks was noted. Figures 2, 3, and 4 show general condition of this runway.
Runway 03L-21R	Portland cement concrete	All	Excellent - except for occasional hairline cracks penetrating through slab entire depth.
Runway 08-26	Asphaltic concrete	All	The entire runway is in very poor condition. Cracks penetrating the entire thickness of the pavement are closely spaced, open, full of sand, and cracked edges are curling. No crack sealing was evidenced. Figures 5 and 6 show general condition of this runway.
Runway 17-35	Portland cement concrete	0+00-4+25	Good - occasional hairline crack.
	Asphaltic concrete	0+00-55+45	Poor - severe map, longitudinal and transverse cracking - some cracks 2 inches wide. Sand in open cracks was causing spalling and curling. Figures 7 and 8 are typical of the pavement conditions.

Pavement Facility	Type	Stationing	Condition
Taxiway 1	Asphaltic concrete	All	Poor - severe map, longitudinal and transverse cracking. No maintenance was in evidence except an old slurry coat.
Taxiway 1-A	Asphaltic concrete	All	Good - open graded surface but free of cracks except for occasional longitudinal cracking.
Taxiway 1-B	Asphaltic concrete	All	Poor - severe map cracking to 0.6 inch wide with spalling and curling of open cracks. Crack pattern ranges from 3 inches between smaller cracks to several feet between the larger ones. Figures 5 and 6 are typical of this area also.
Taxiway 2	Asphaltic concrete	All	Fair - surface unsealed with longitudinal cracking. Transverse cracks near right edge. No cracks over 1/16 inch wide.
Taxiway 4	Portland cement concrete	All	Excellent - some spalling at construction joints was noted but had been carefully repaired and heavily seal-coated.
Taxiway 6	Asphaltic concrete	0+00 to -10+00	Fair - approximately one half the length was excellent. Remaining length had longitudinal and transverse cracks to 3/4-inch wide adjacent to Runway 03R-21L.
	Asphaltic concrete	0+00-19+00	Fair to poor - longitudinal and transverse cracks to 3/4 inch wide.
Taxiway 6-A	Asphaltic concrete	All	Fair to poor - longitudinal and transverse crack to 0.5 inch wide. Patched areas - center portion seal coated at one time, outer edges open graded.

Pavement Facility	Type	Stationing	Condition
Parking Apron	Portland cement concrete	All	Area adjacent to Taxiway 5 and 6-A badly cracked with some vertical displacement at joints. East end adjacent to hangers recently replaced and in excellent condition. Central area good to poor with sections of severe cracking.

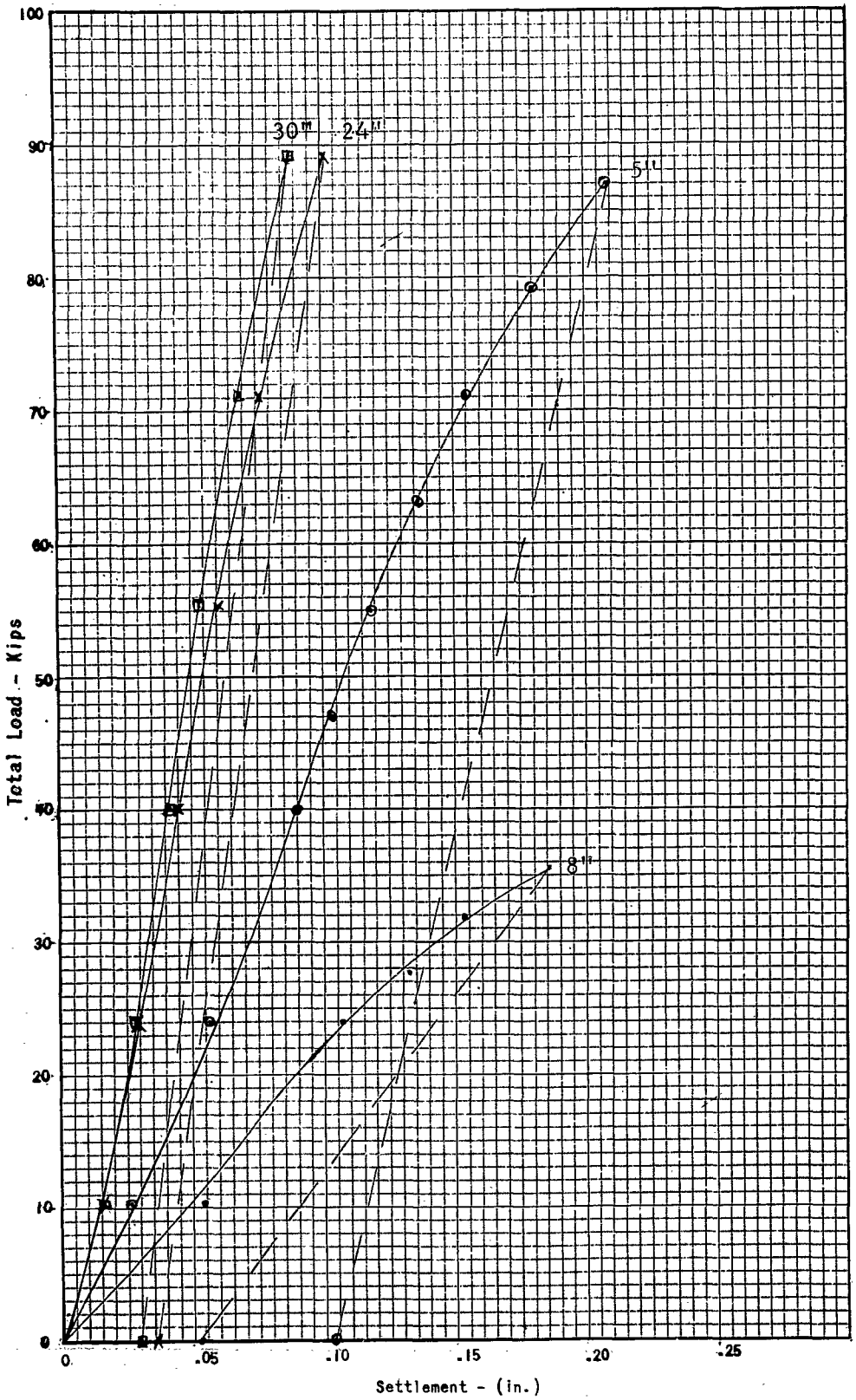
Appendix D

SURFACE PLATE LOAD TEST RESULTS

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

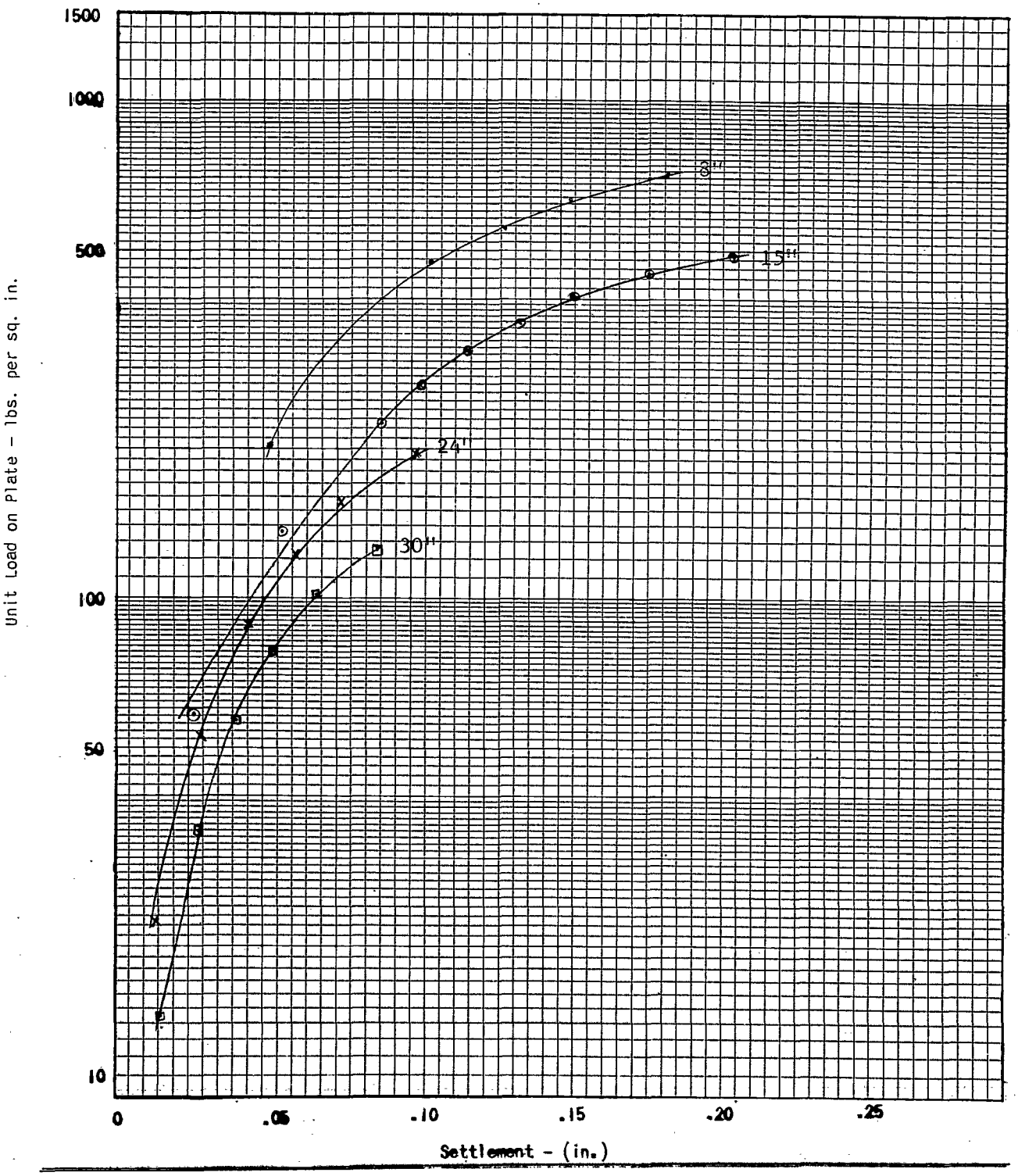
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	15+50



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	15+50

PLATE BEARING TEST DATA

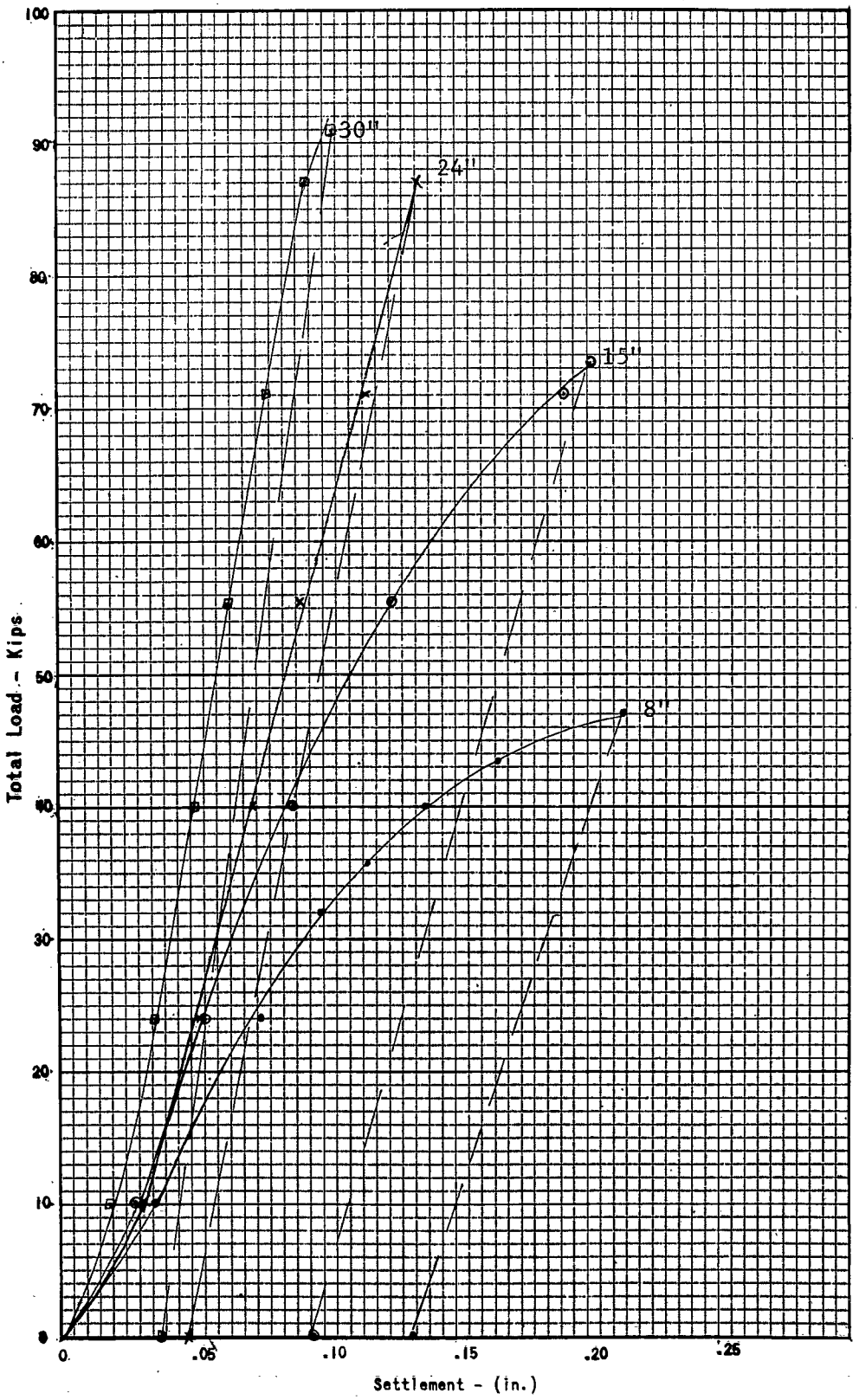
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

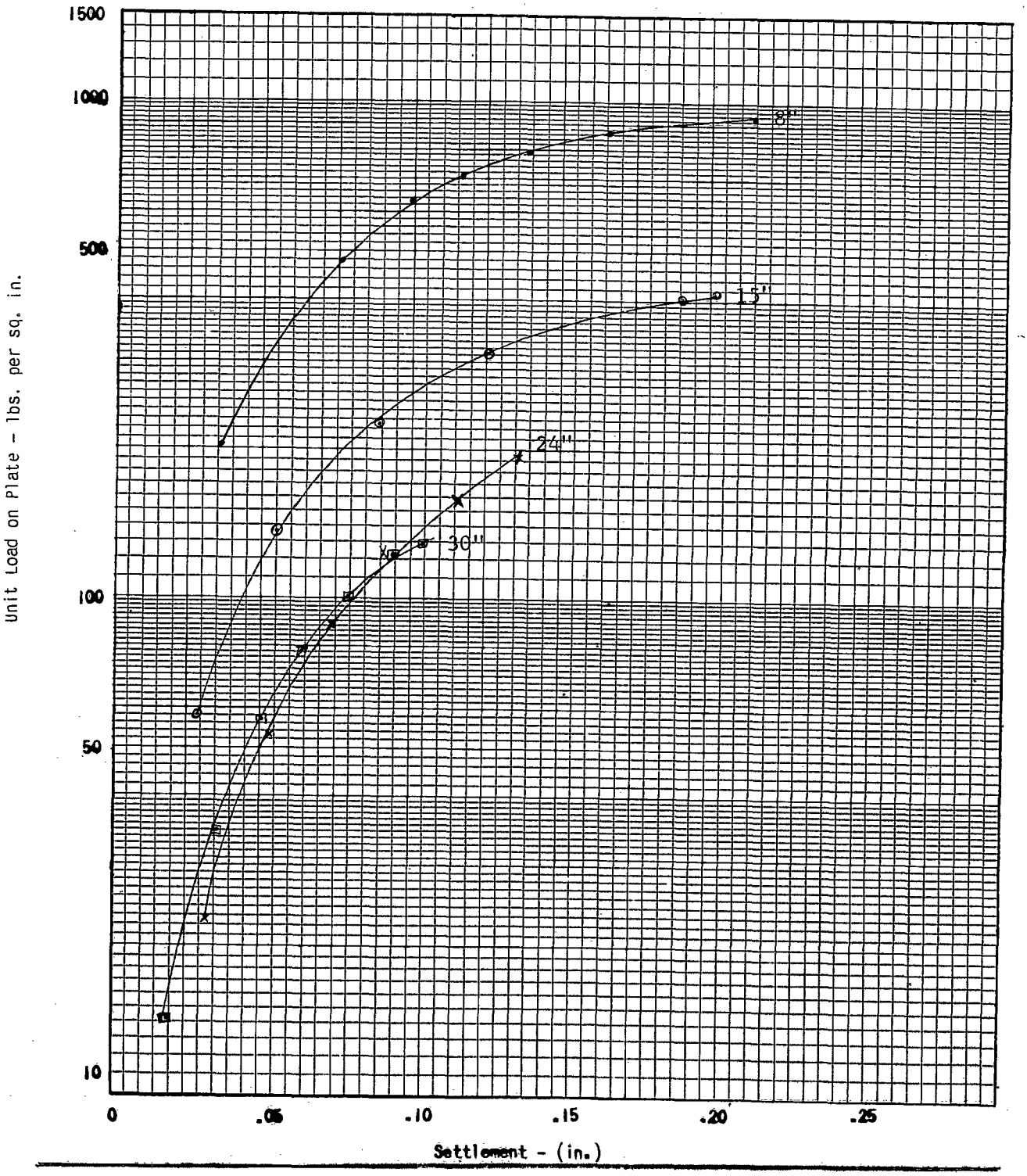
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	25+50



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	25+50

PLATE BEARING TEST DATA

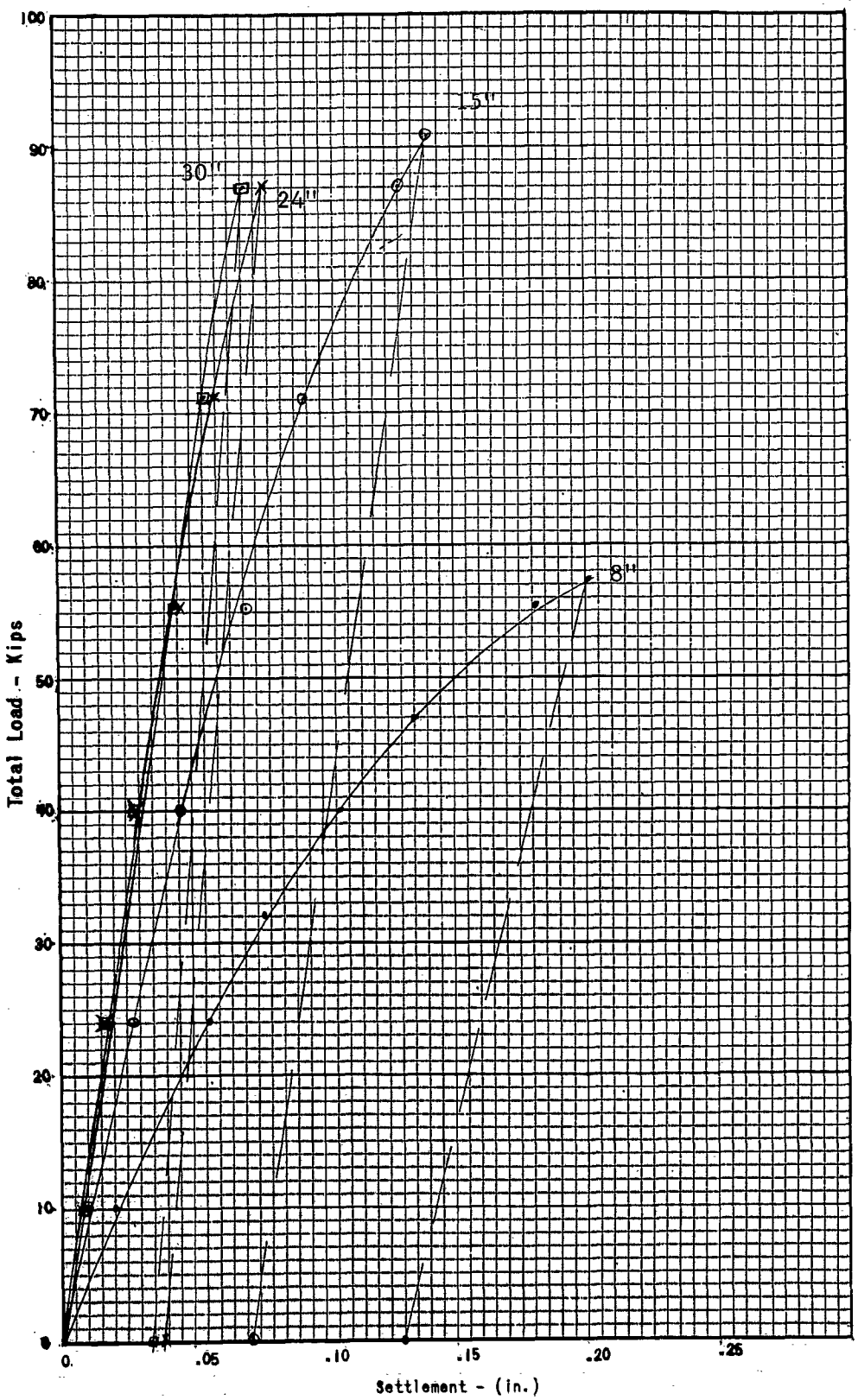
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	35+50

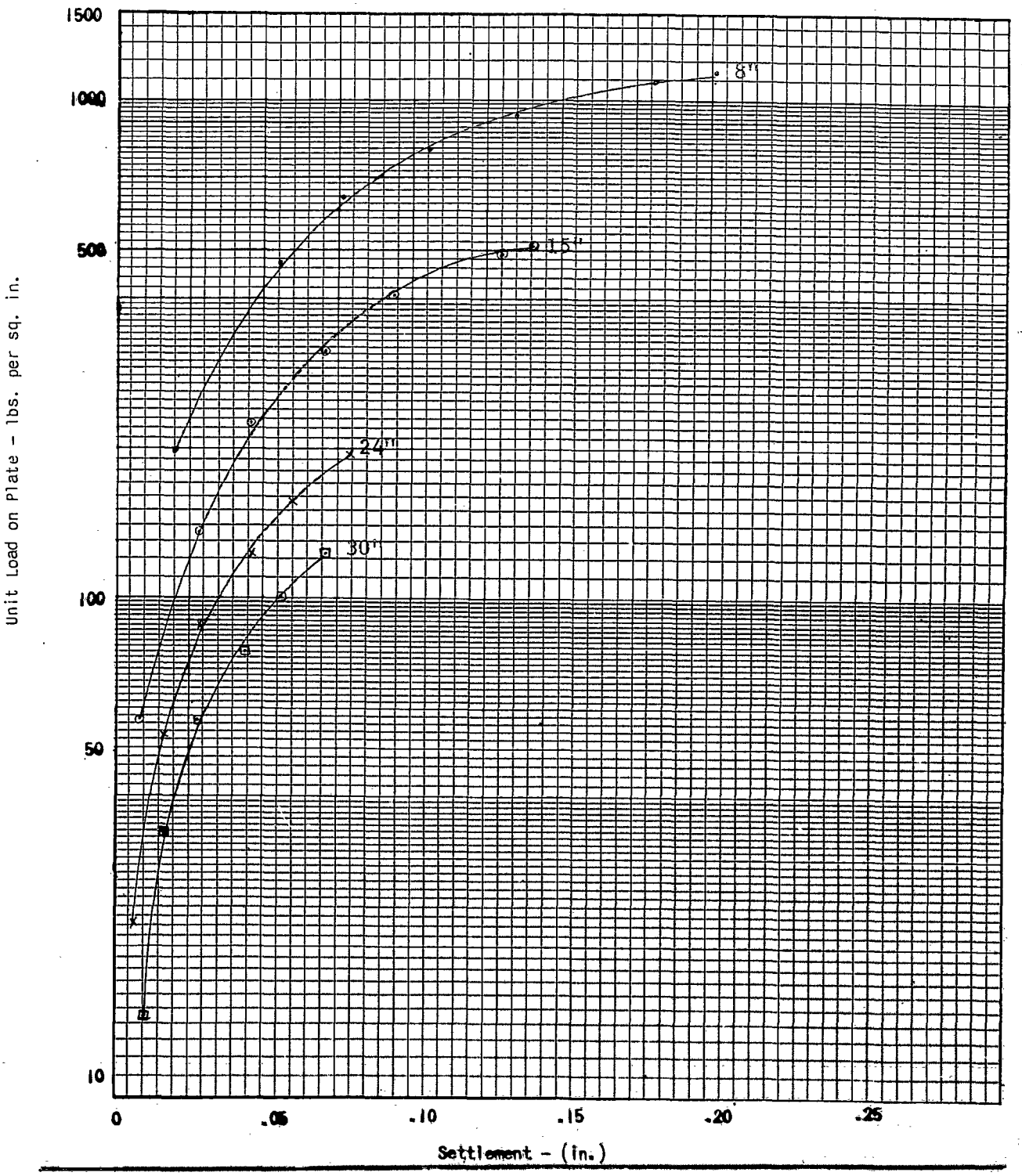


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	35+50

PLATE BEARING TEST DATA

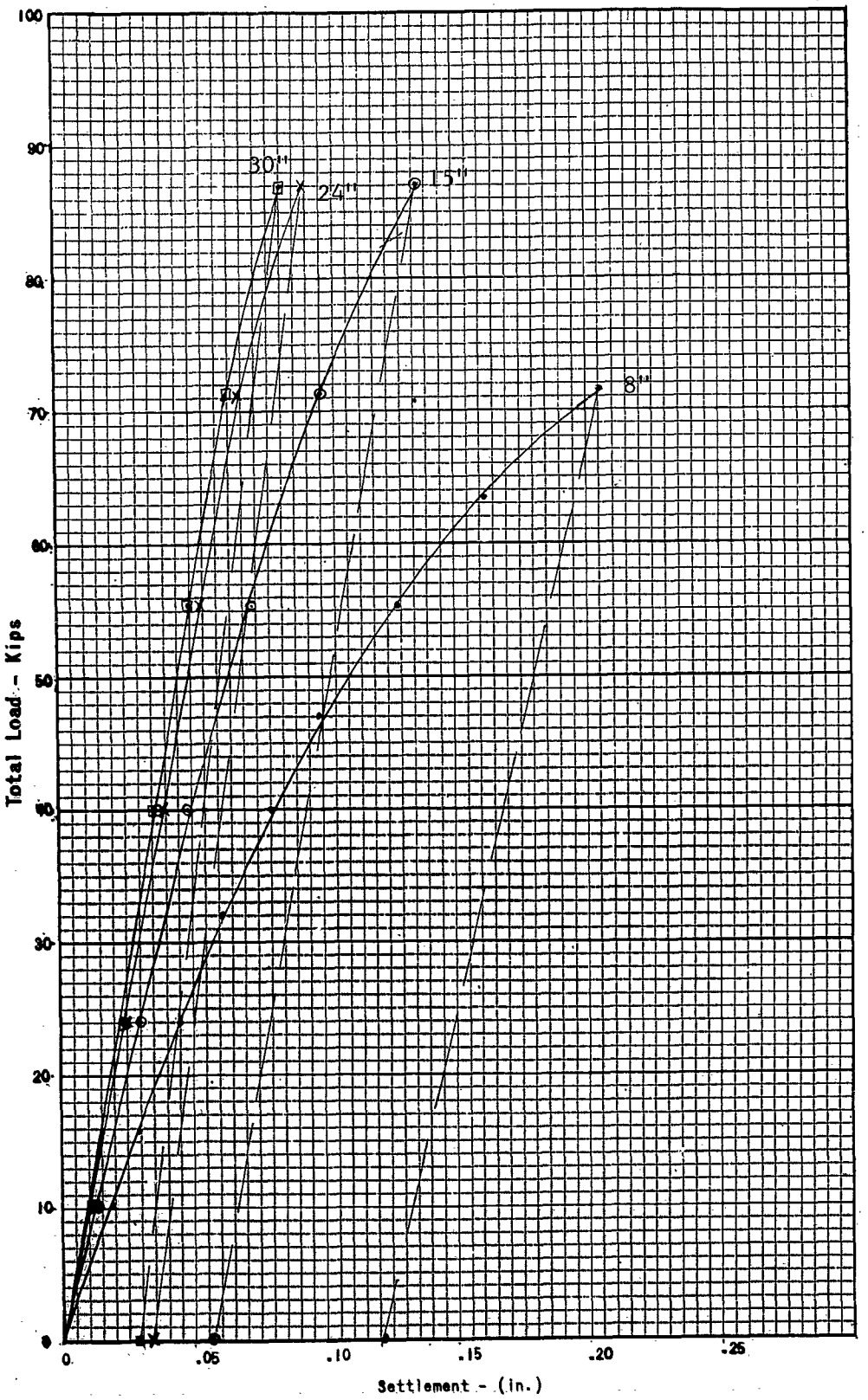
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	55+00

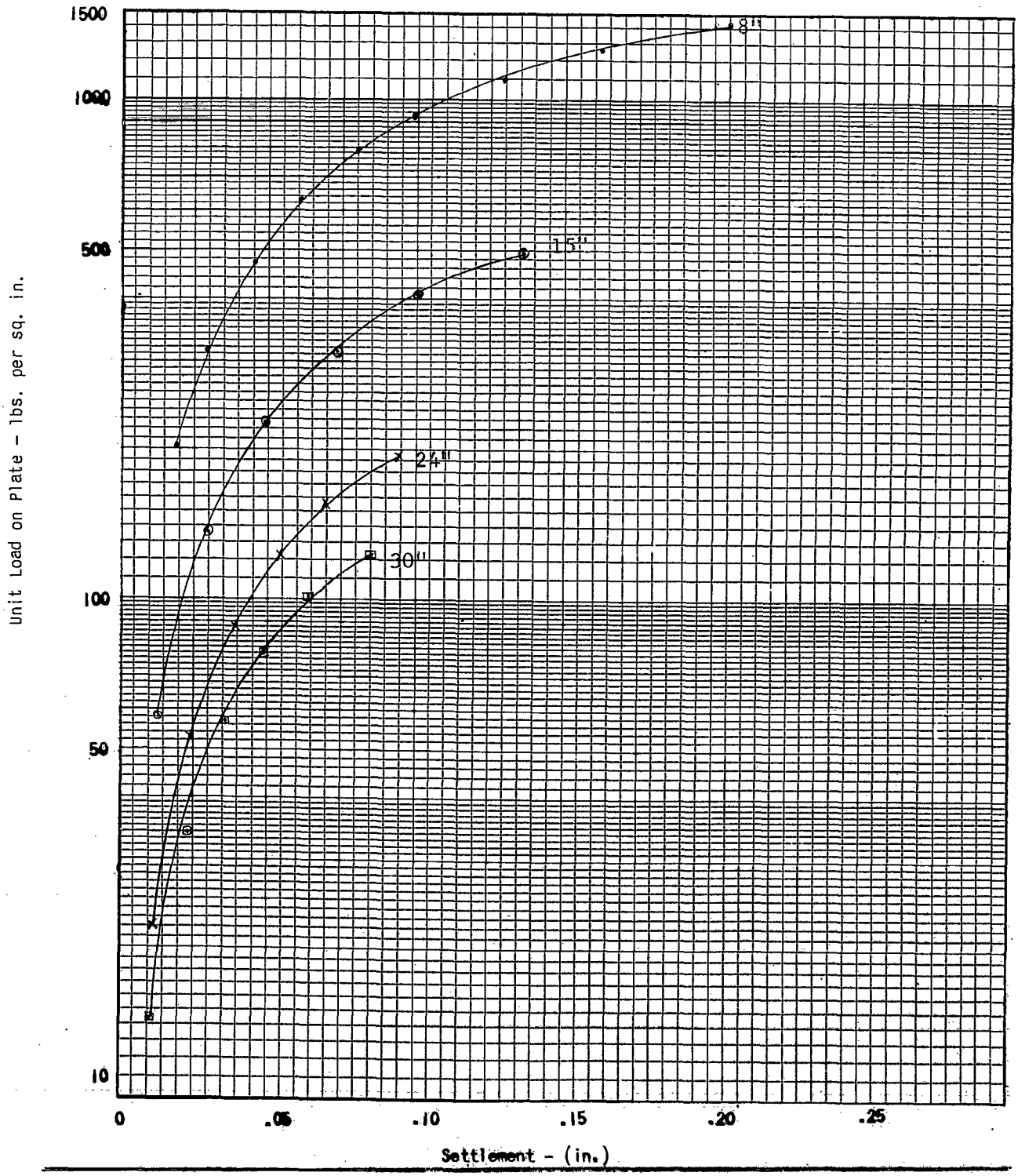


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	55+00

PLATE BEARING TEST DATA

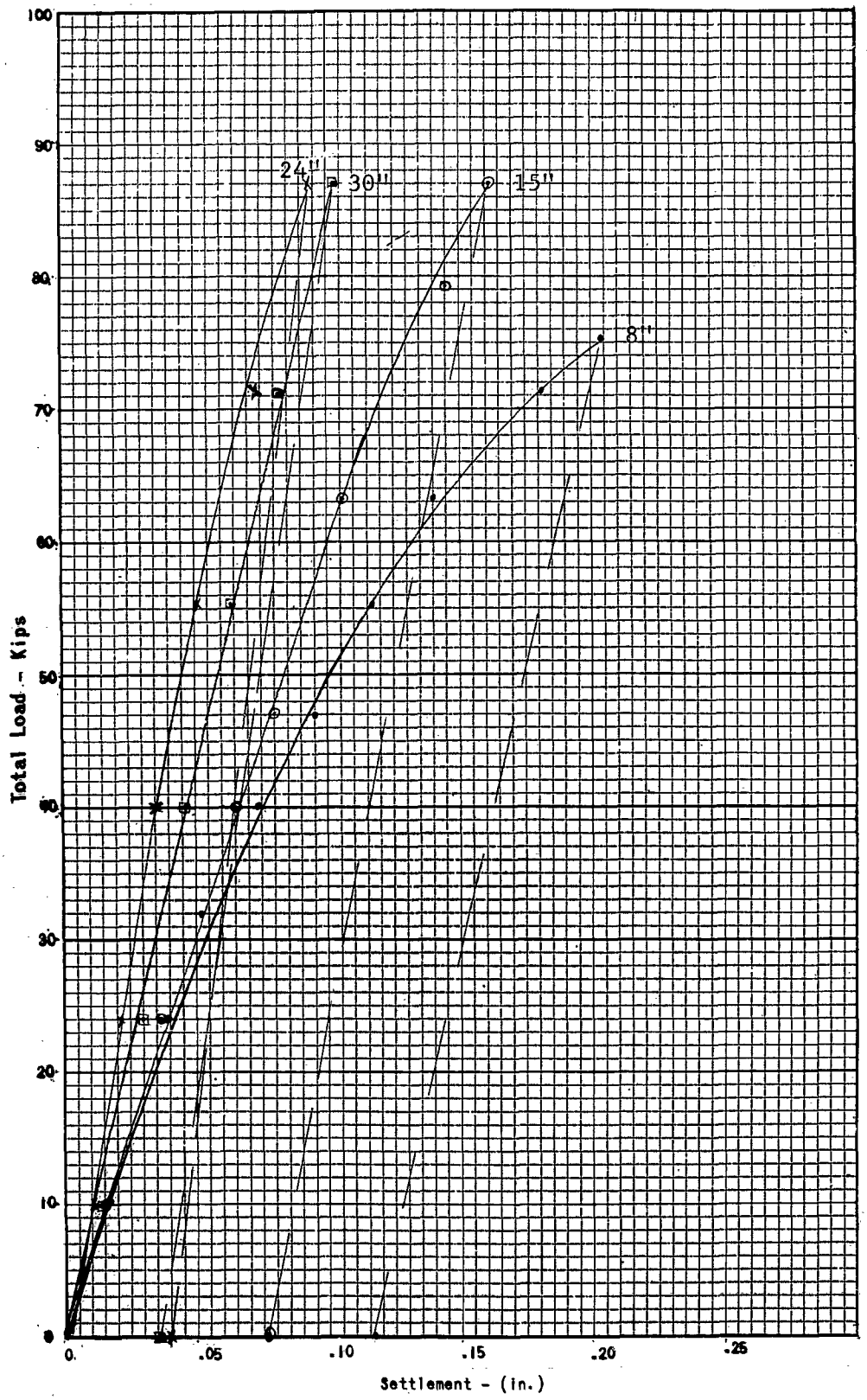
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	65+00

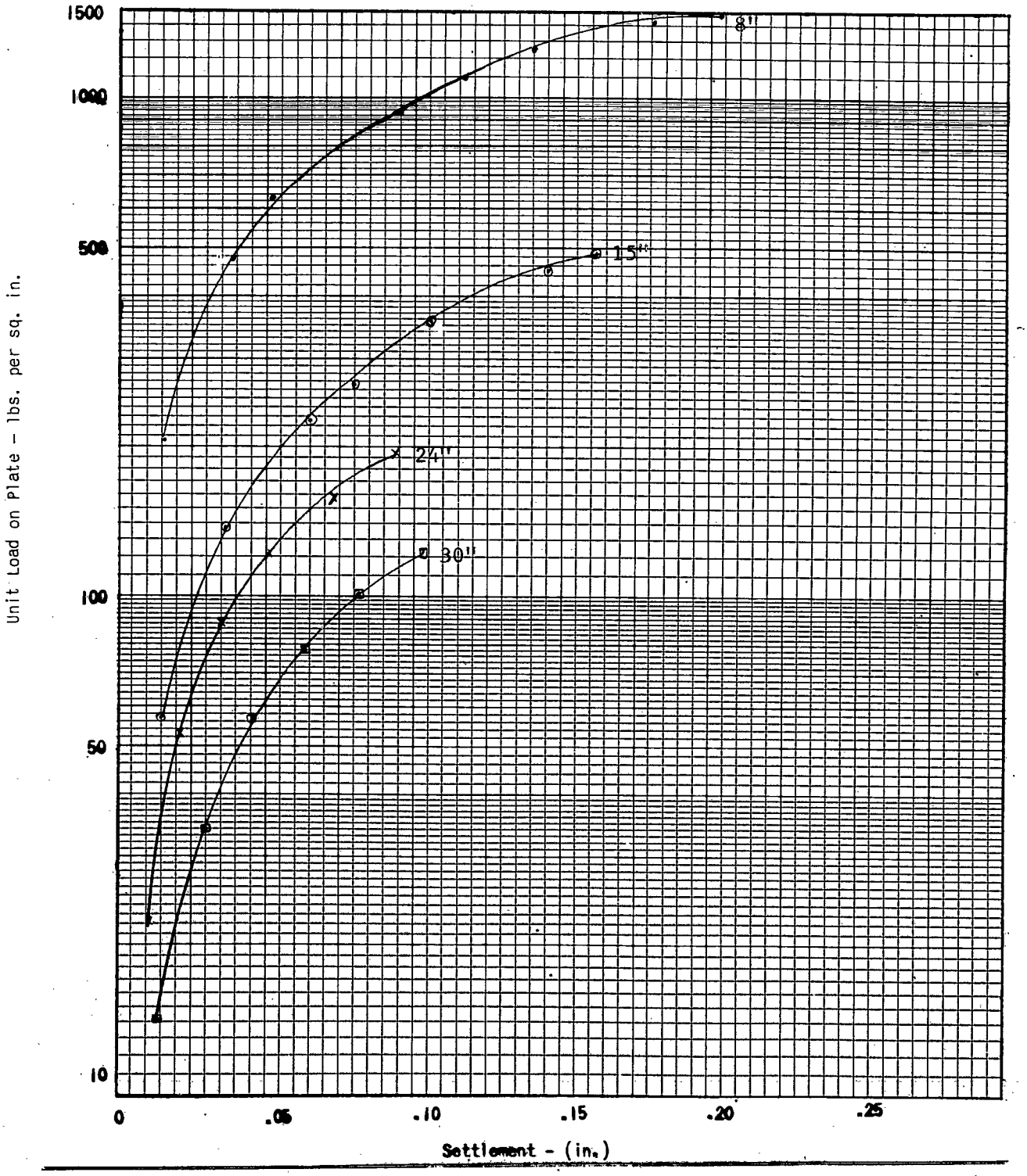


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	65+00

PLATE BEARING TEST DATA

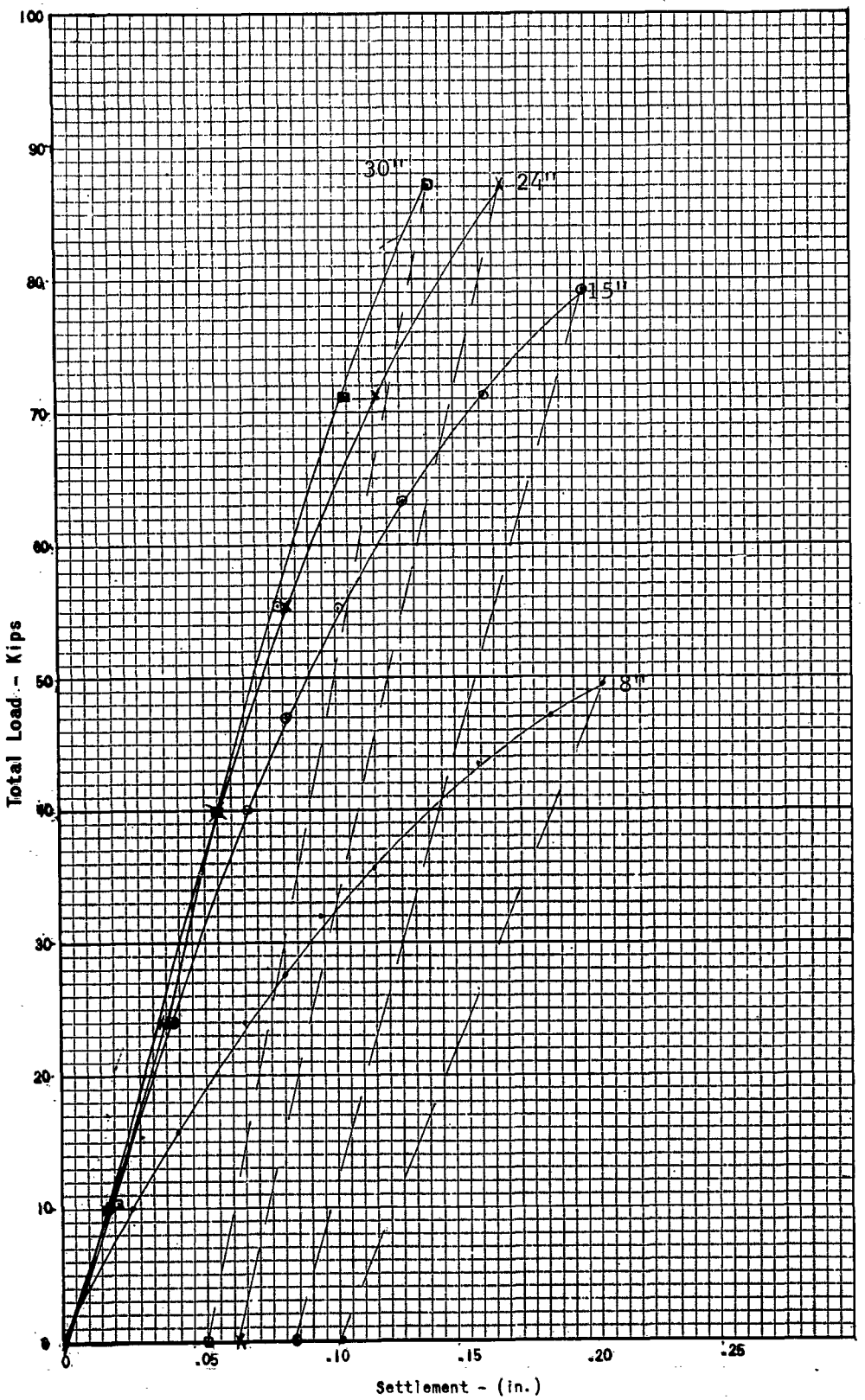
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	75+00

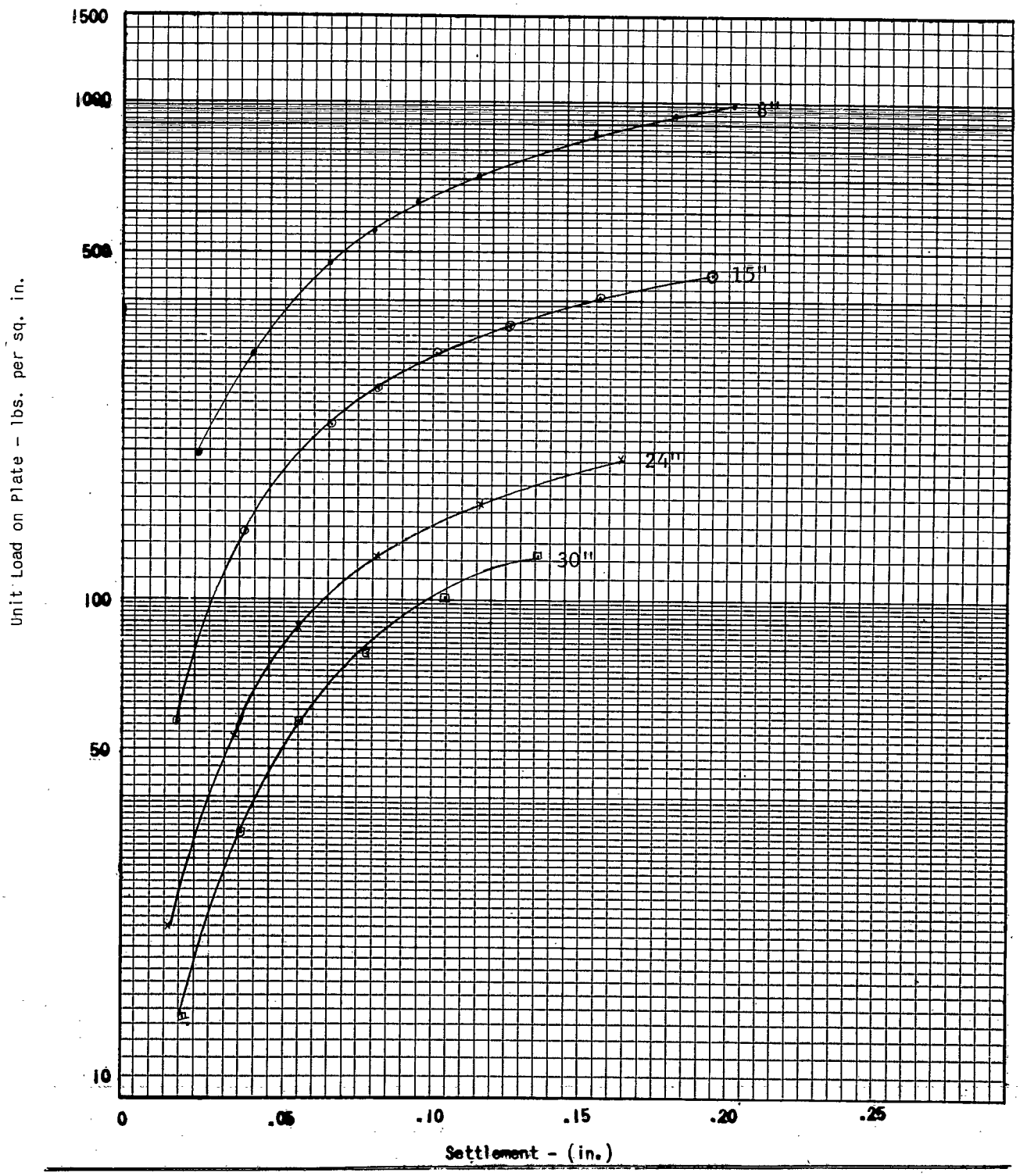


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	75+00

PLATE BEARING TEST DATA

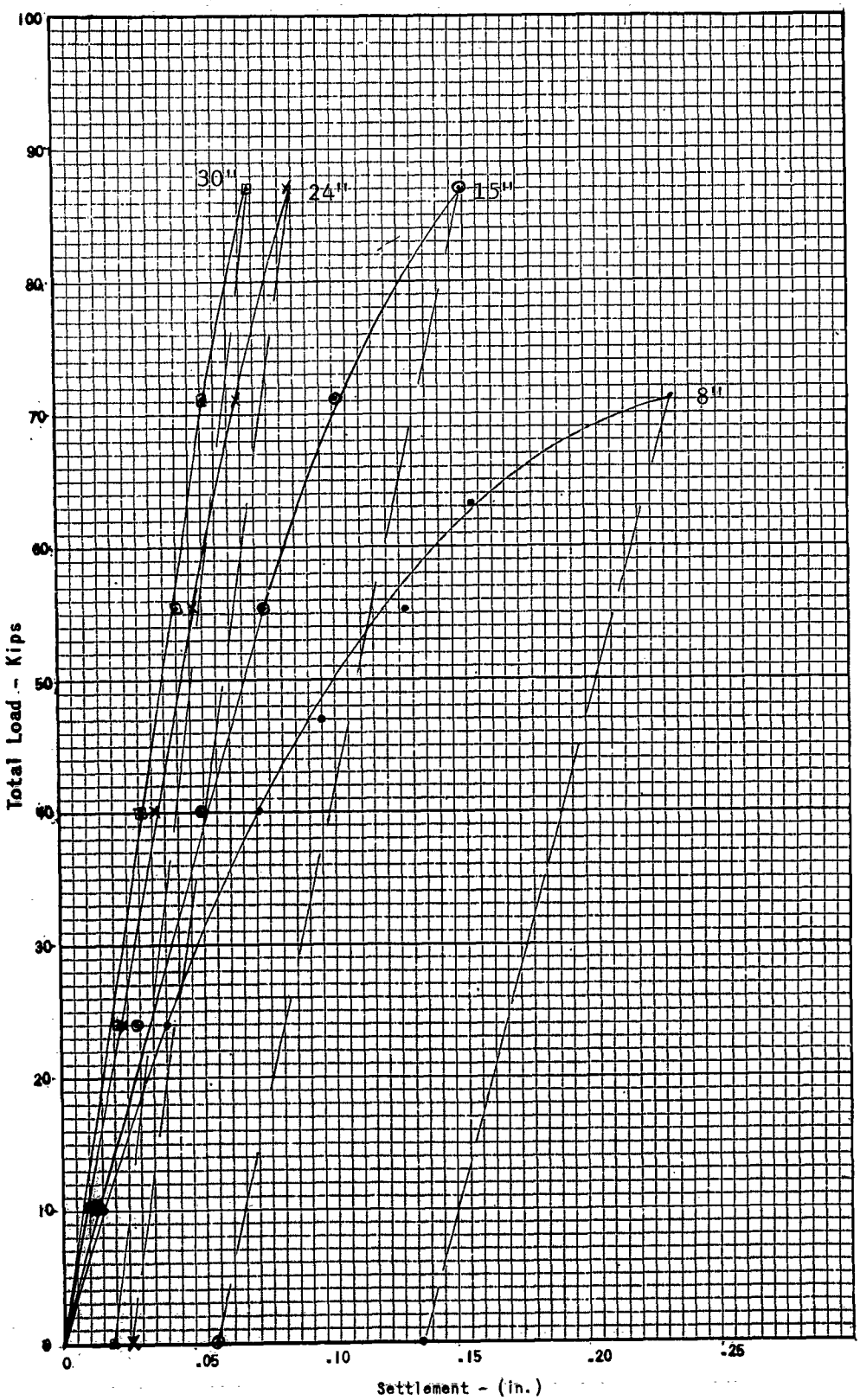
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	85+00

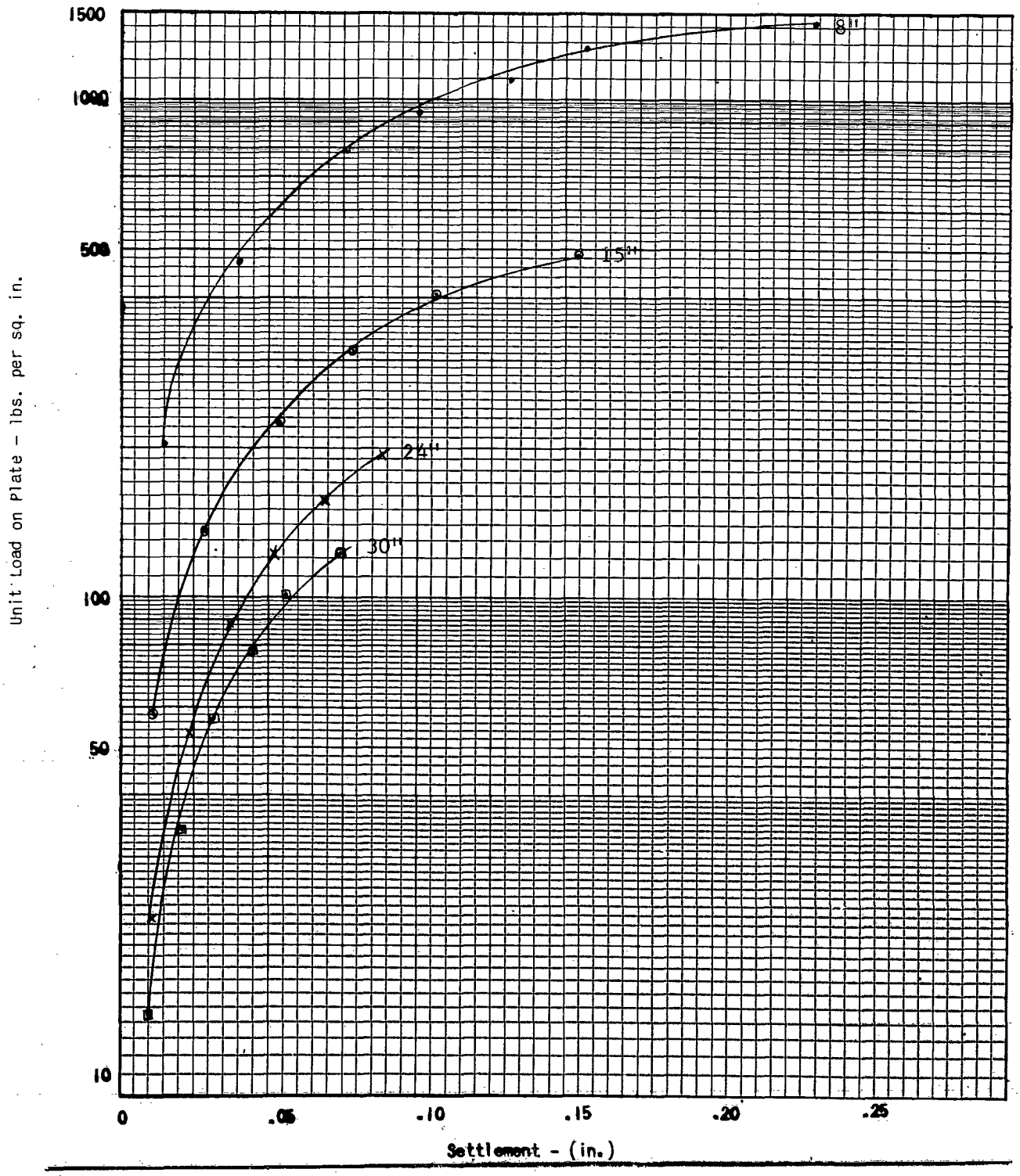


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	85+00

PLATE BEARING TEST DATA

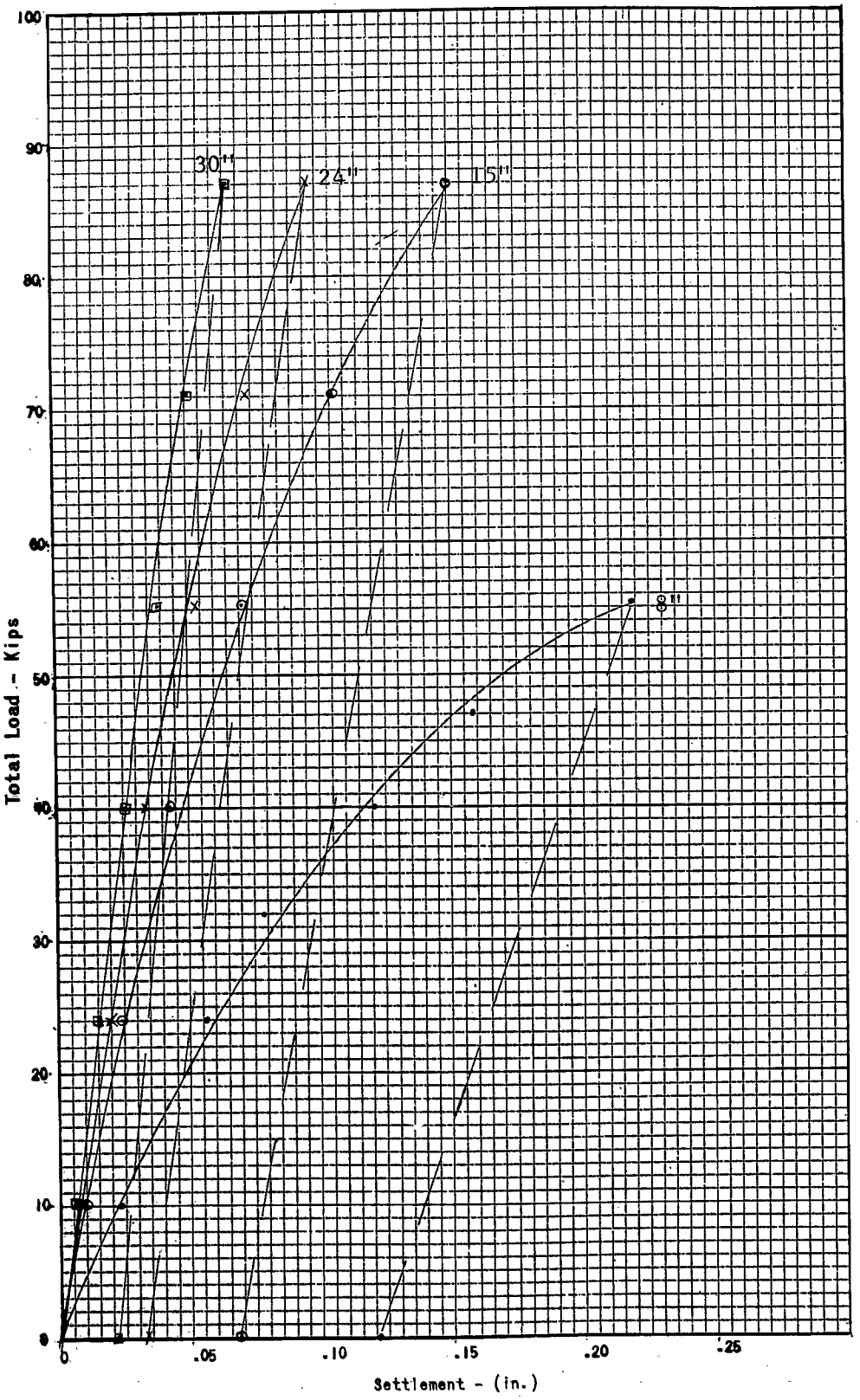
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

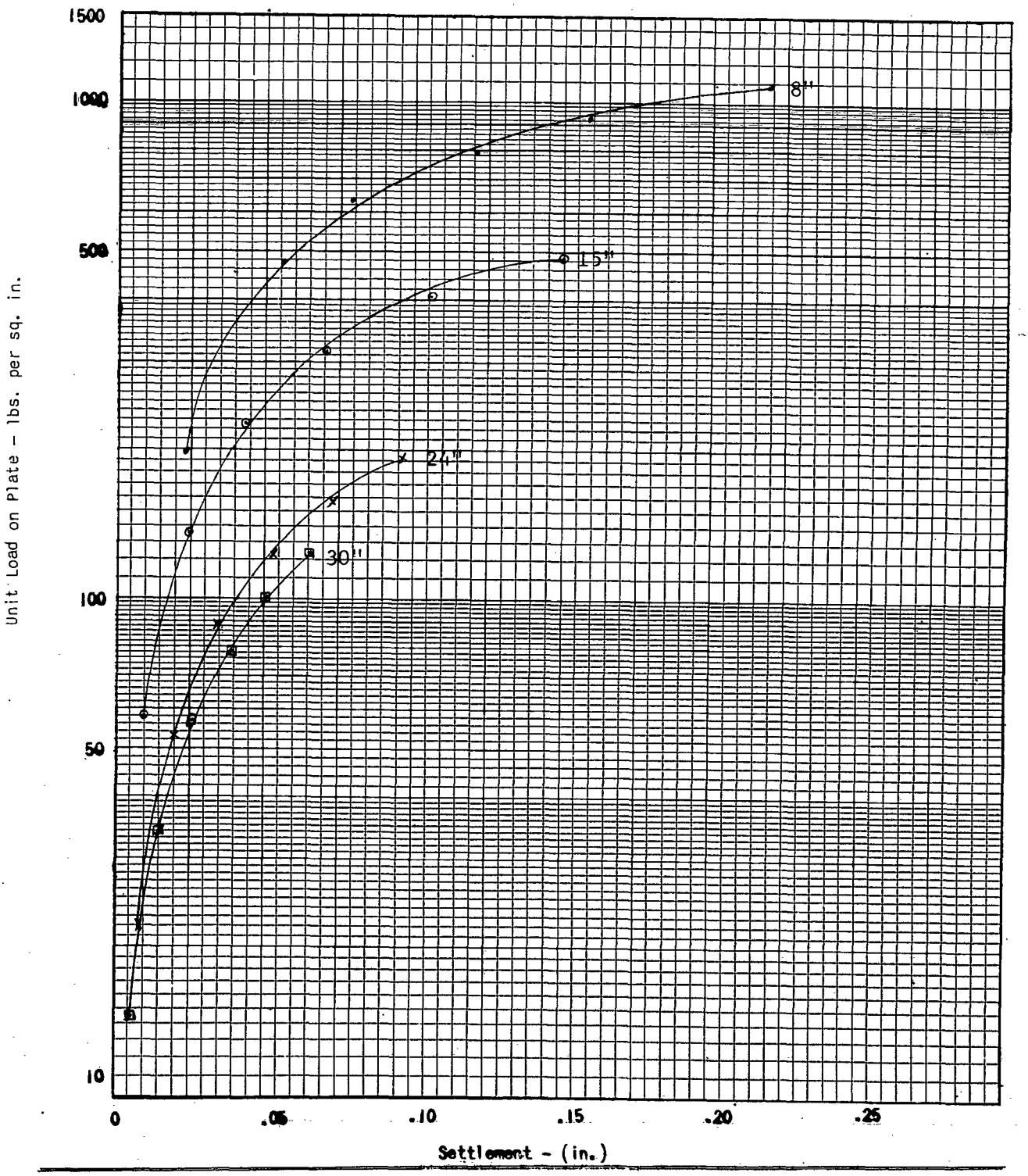
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	93+50



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	93+50

PLATE BEARING TEST DATA

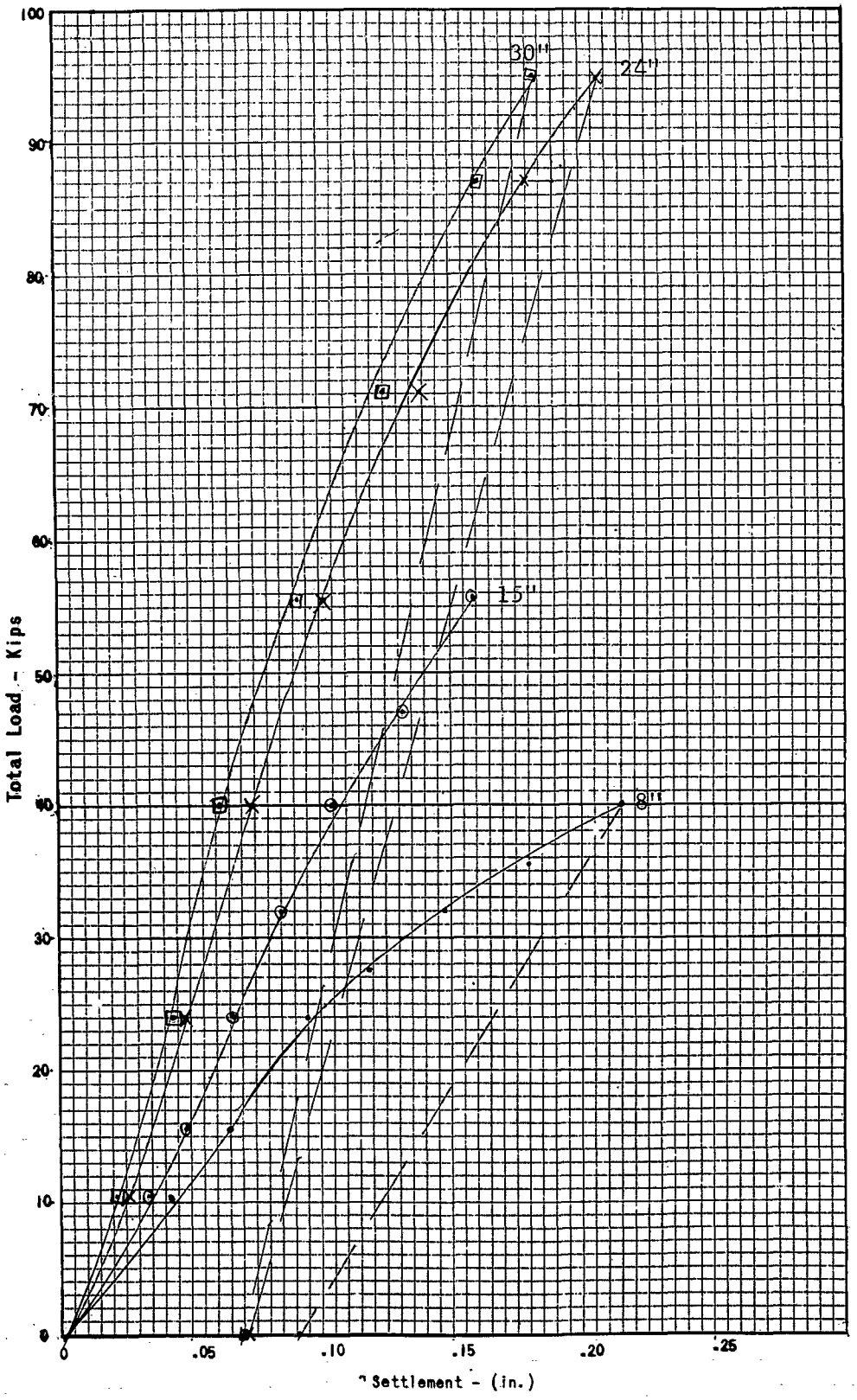
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	1' Runway 08-26	6+00

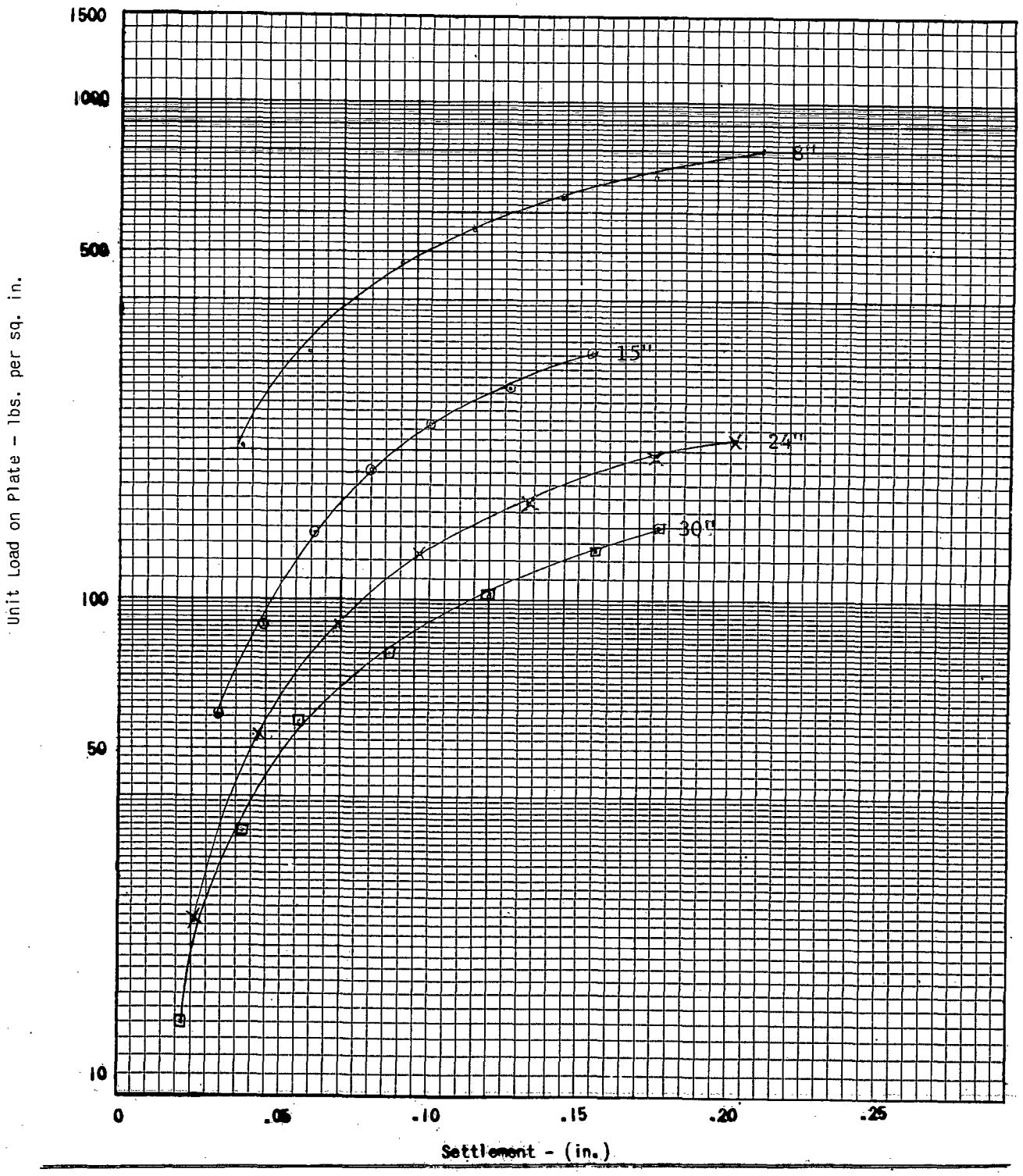


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	6+00

PLATE BEARING TEST DATA

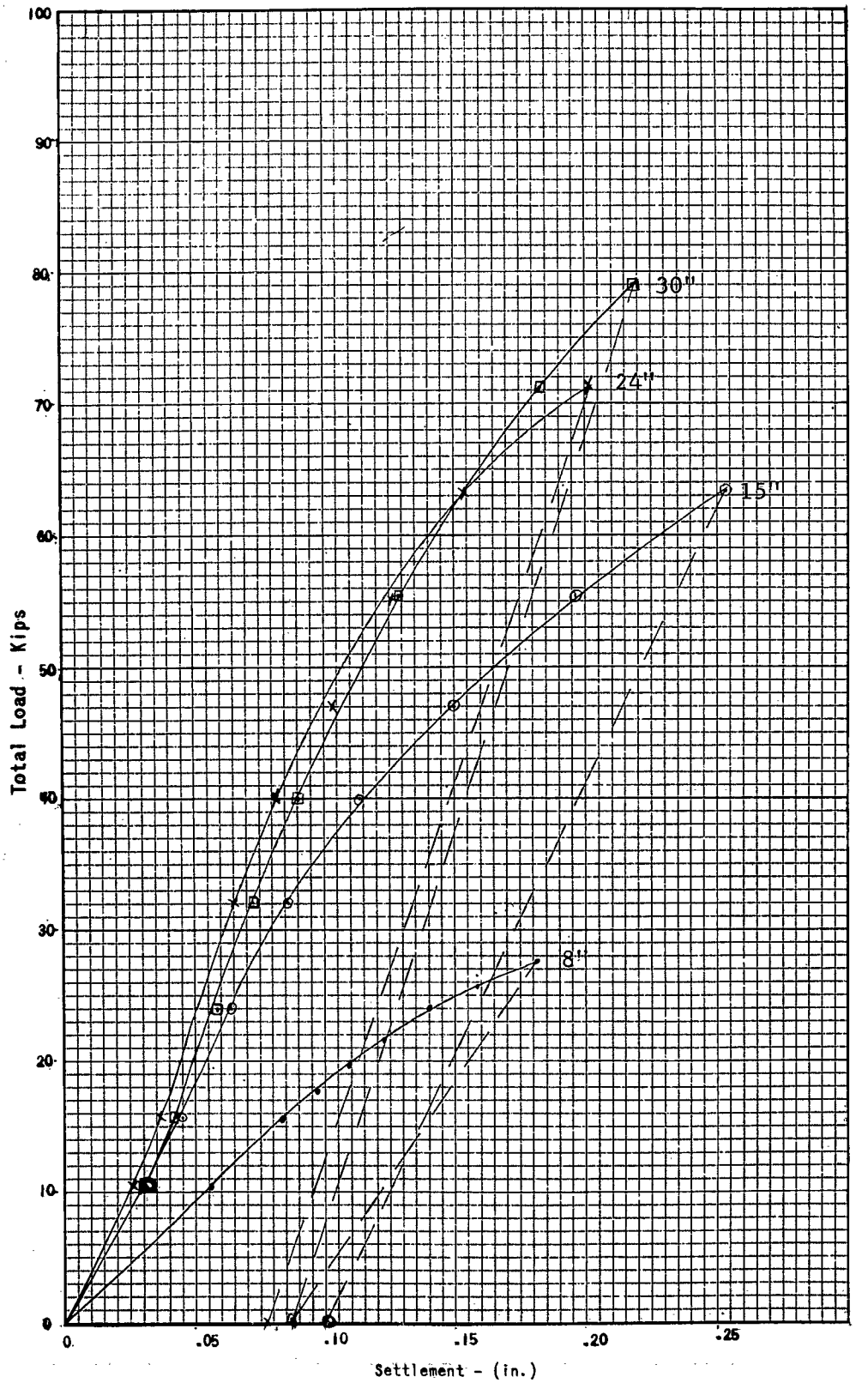
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	16+00

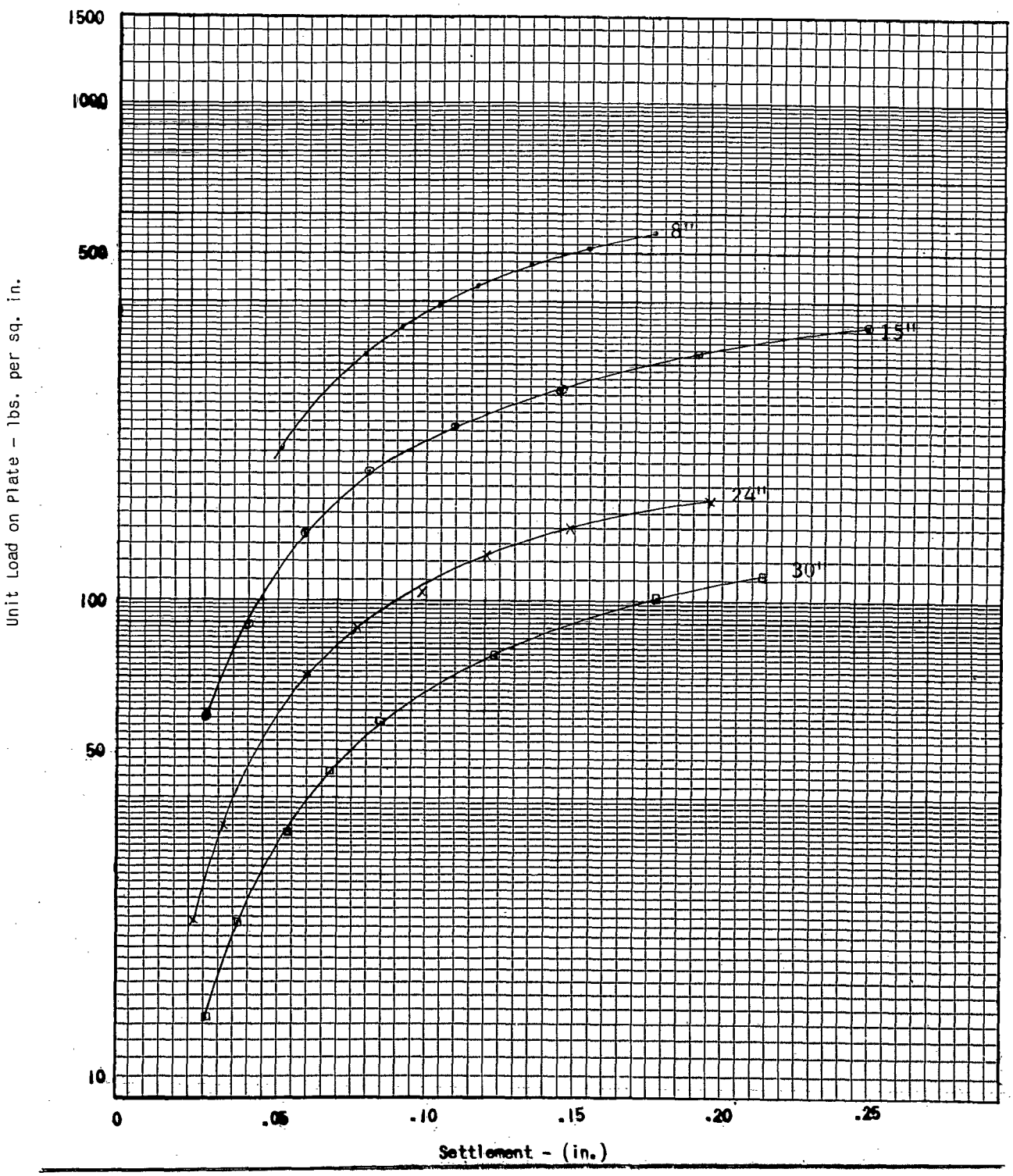


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	16+00

PLATE BEARING TEST DATA

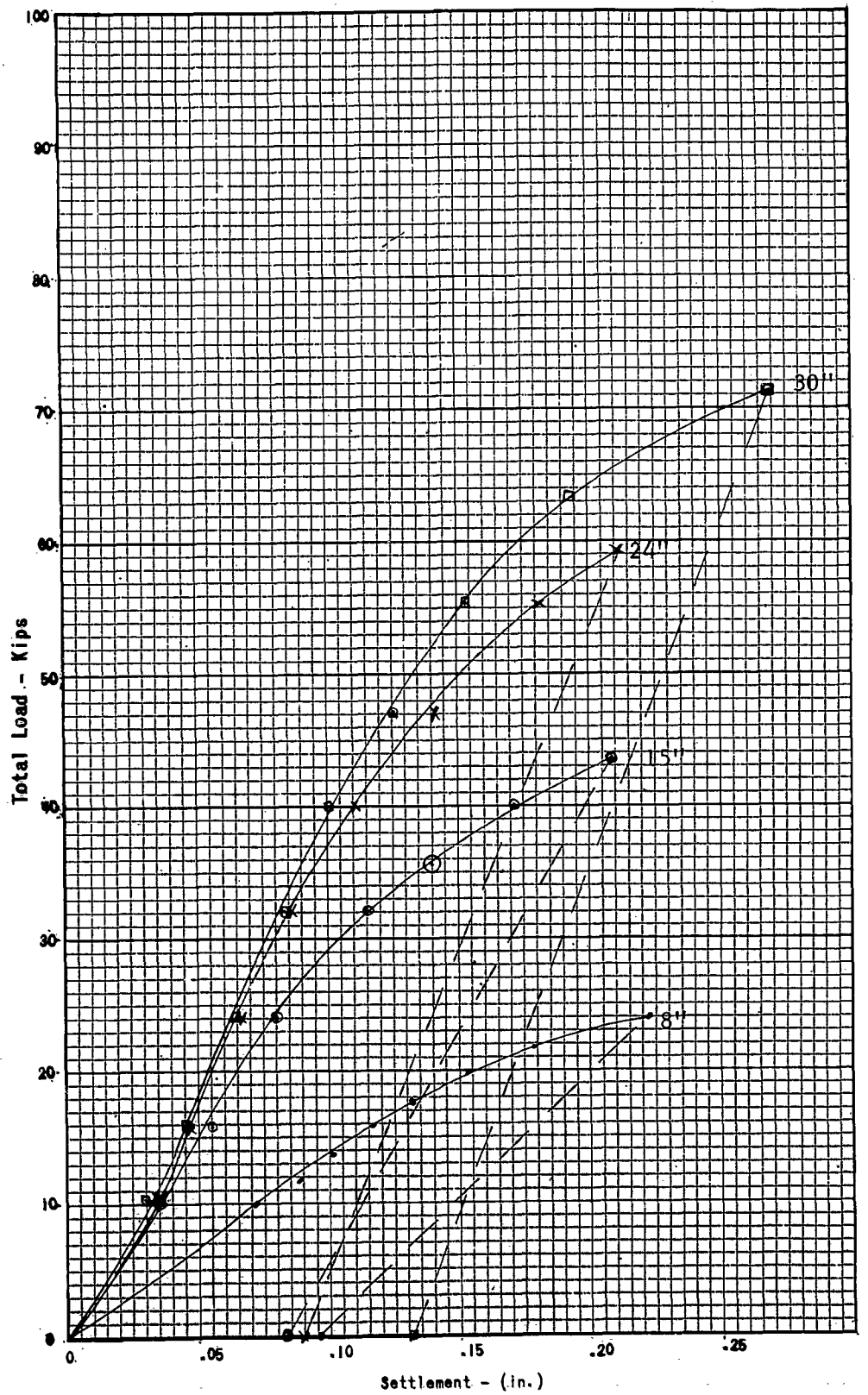
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	26+00

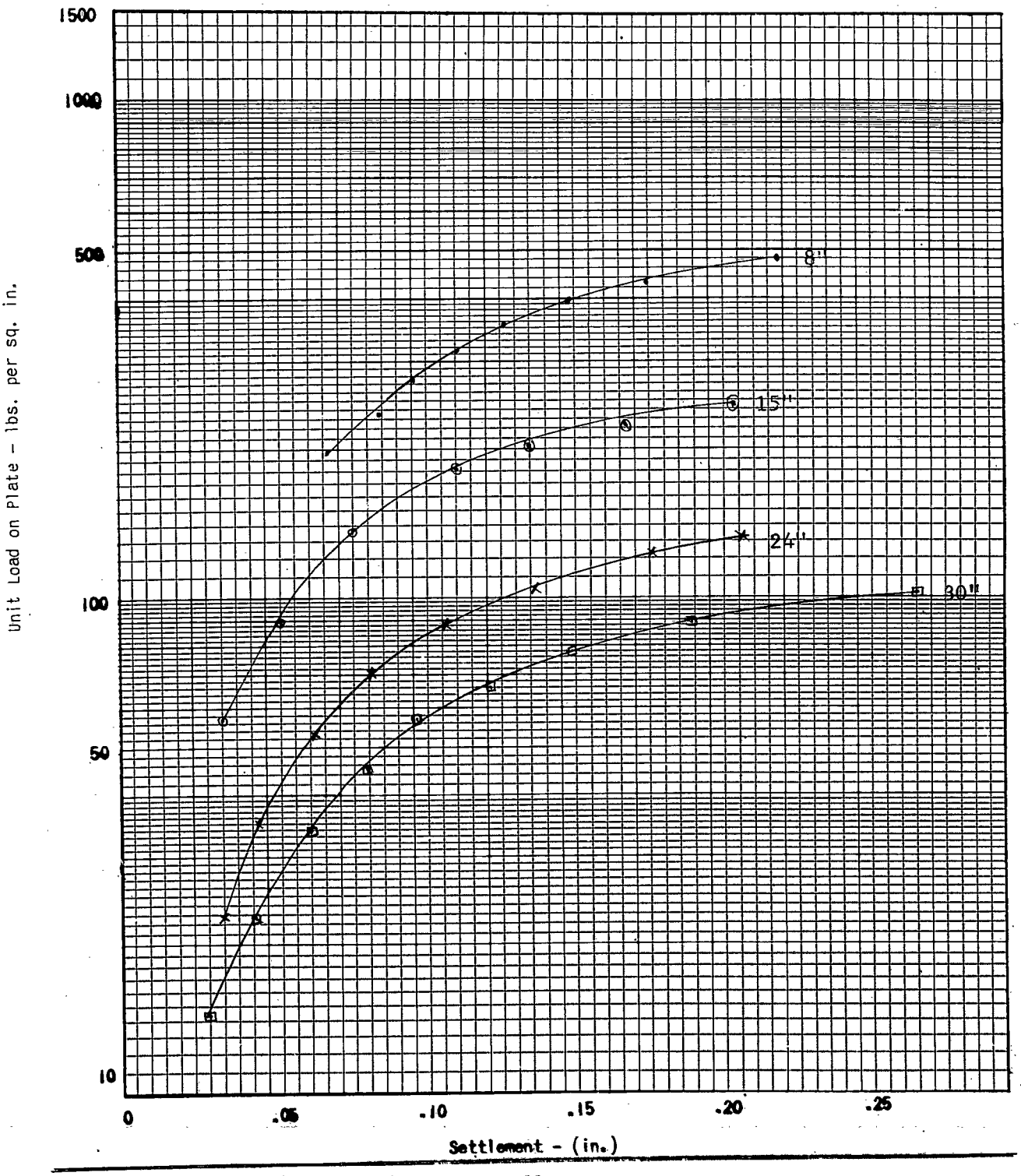


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	26+00

PLATE BEARING TEST DATA

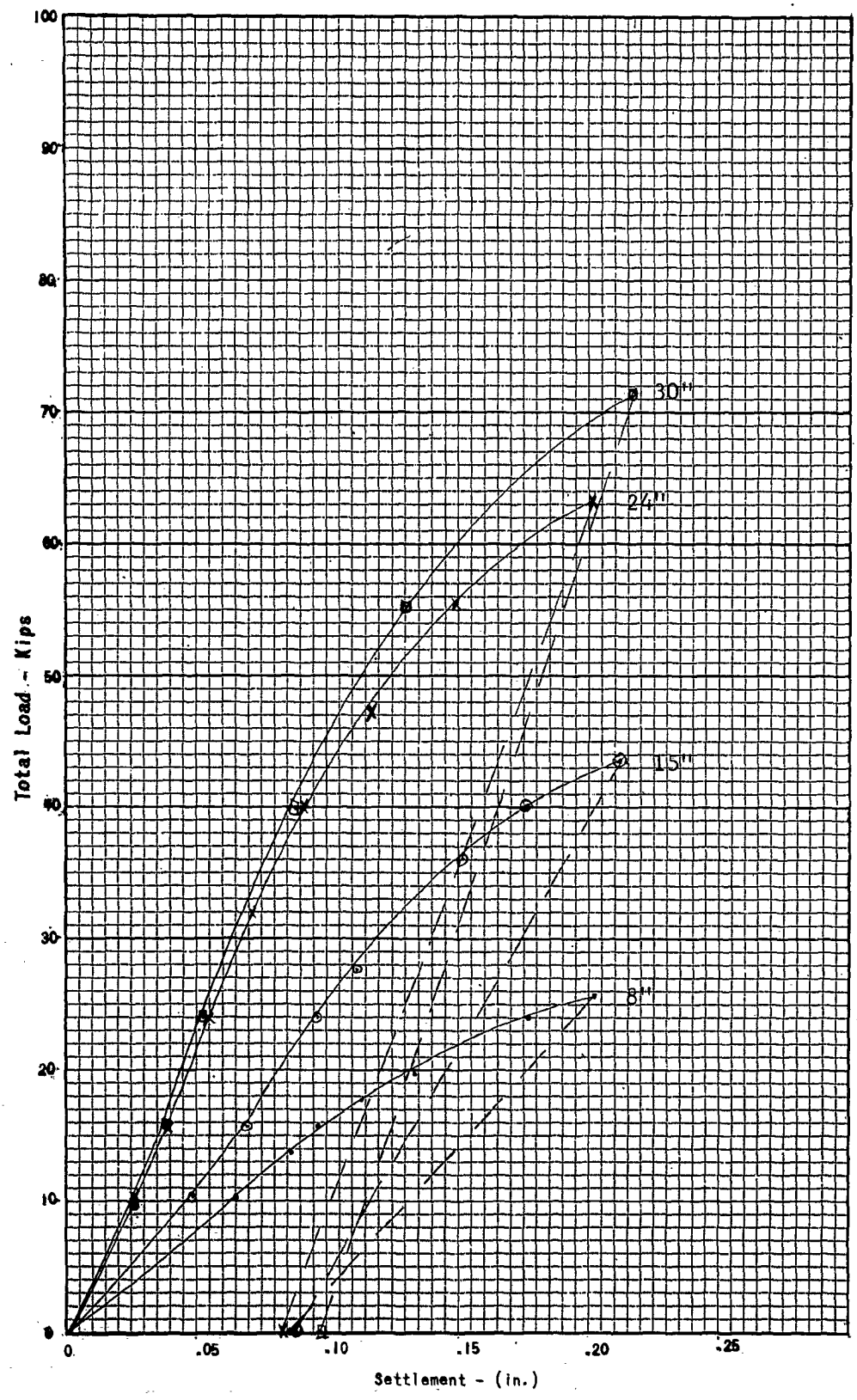
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	36+00

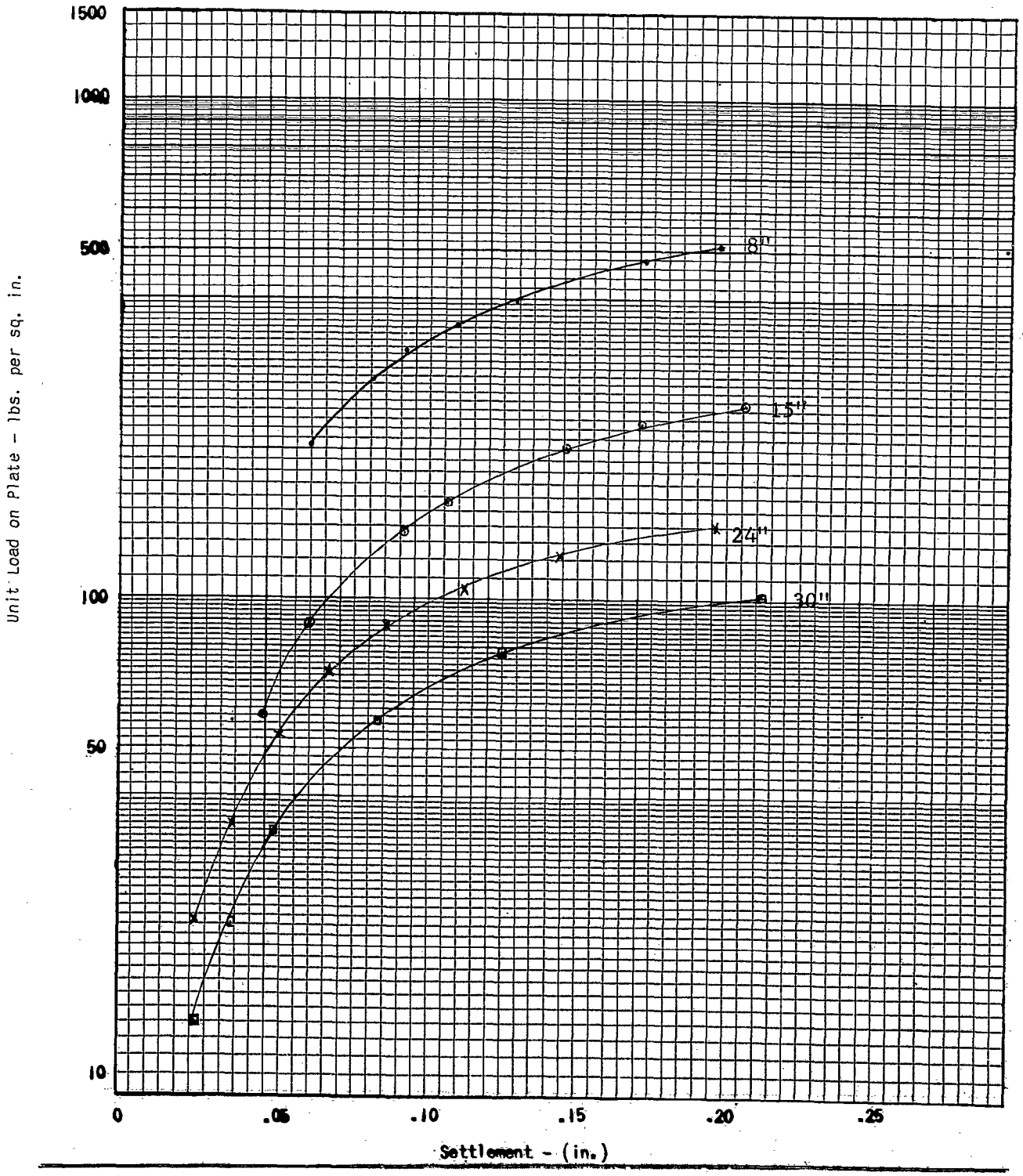


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	36+00

PLATE BEARING TEST DATA

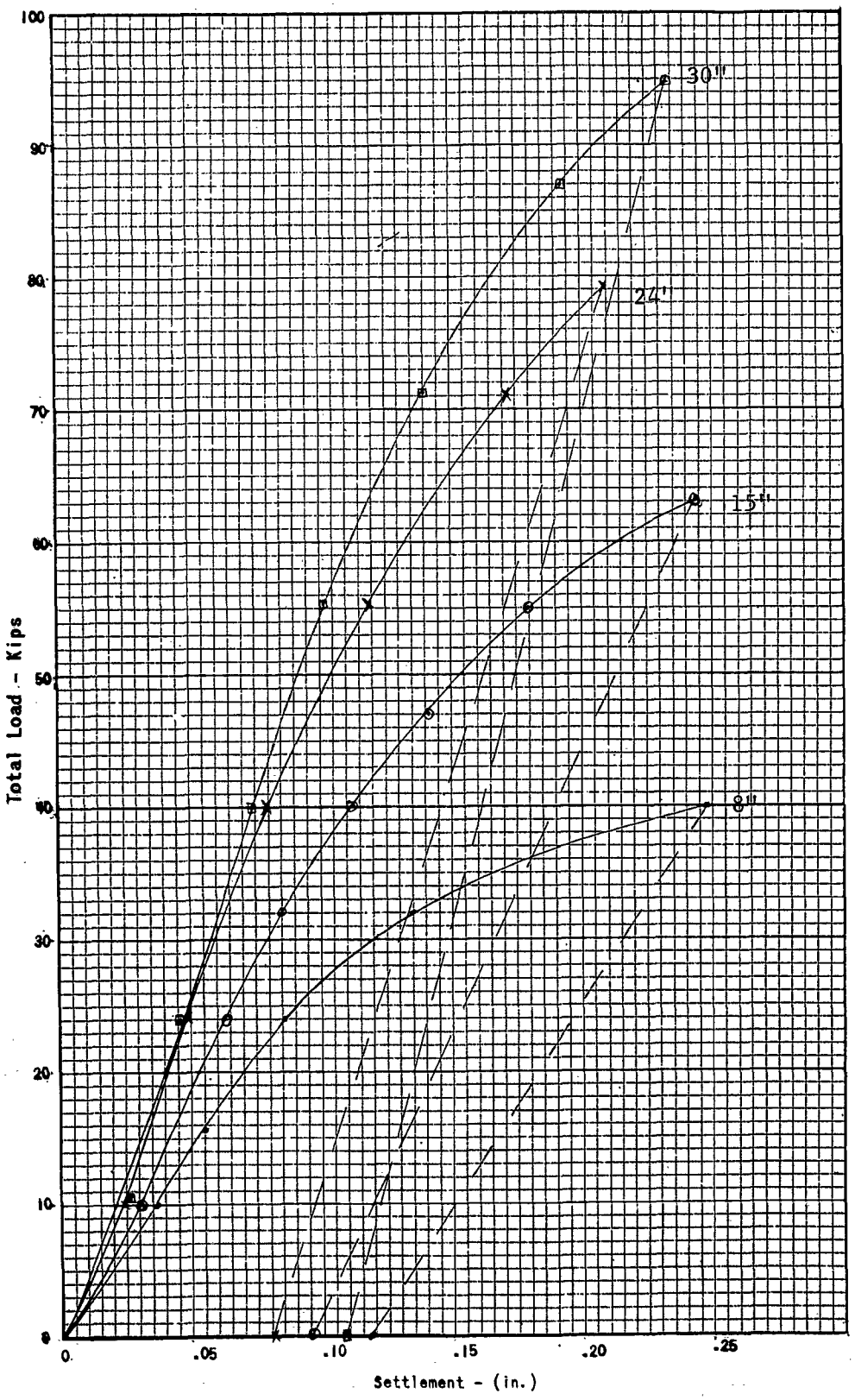
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

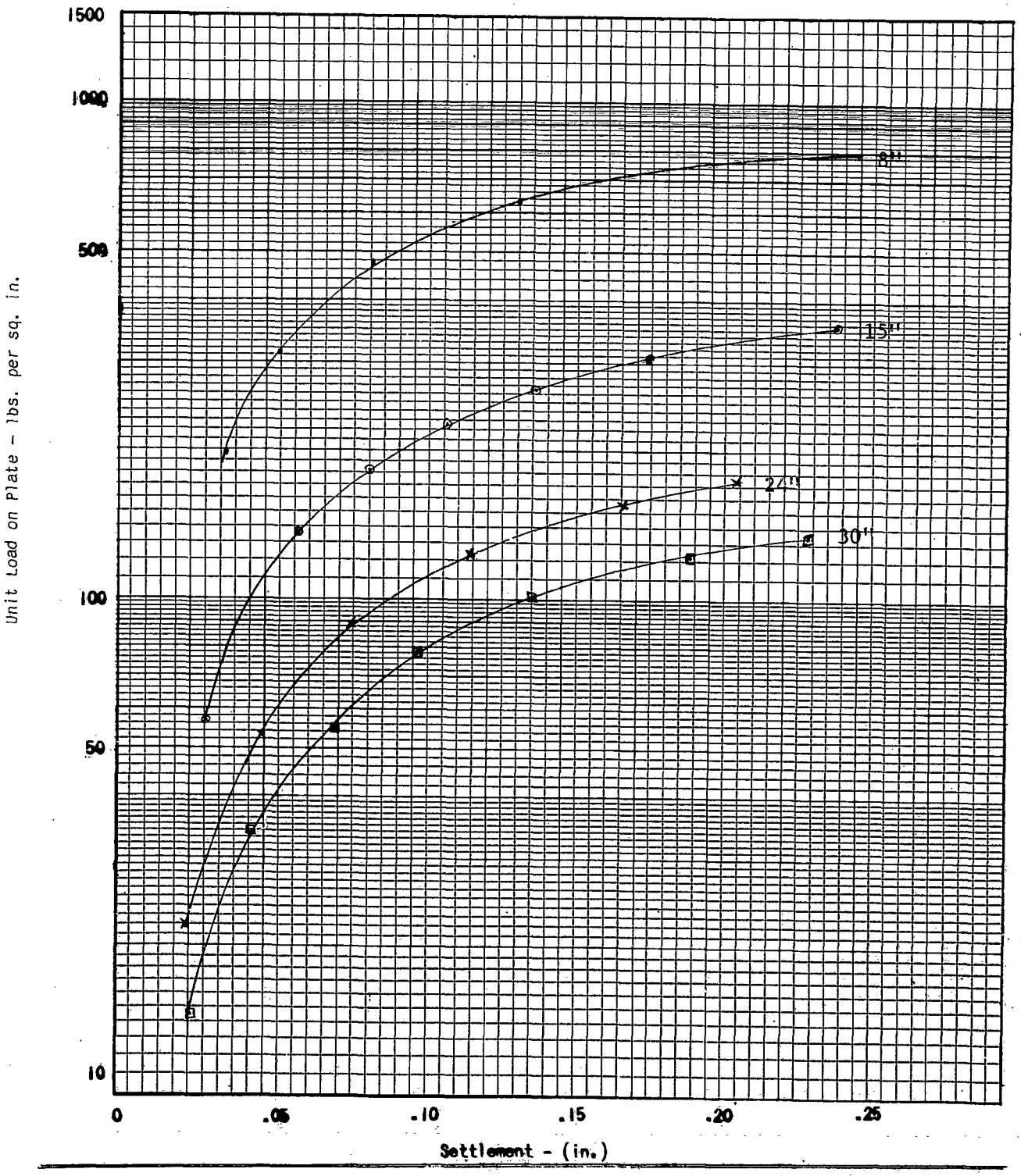
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	46+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	46+00

PLATE BEARING TEST DATA

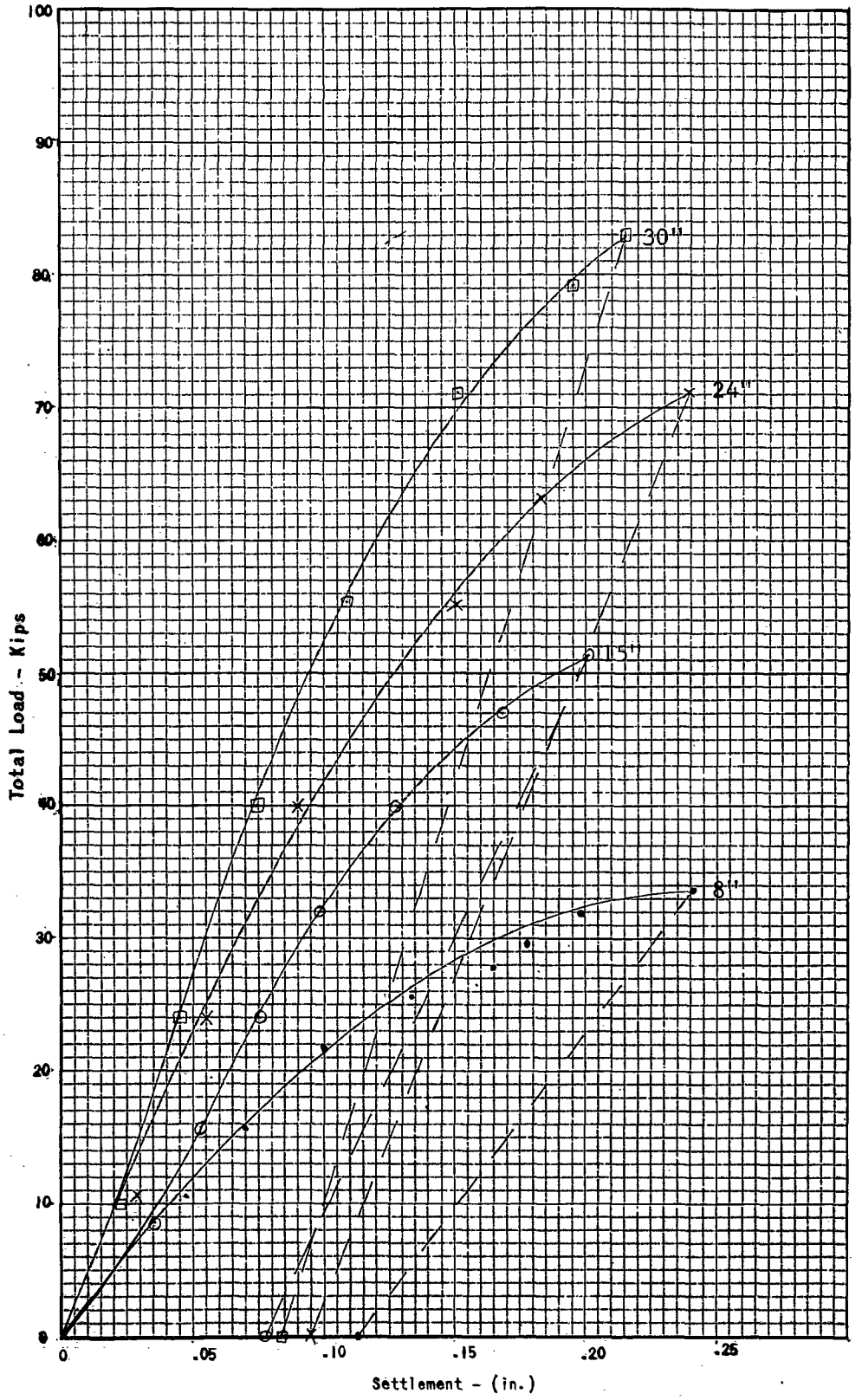
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

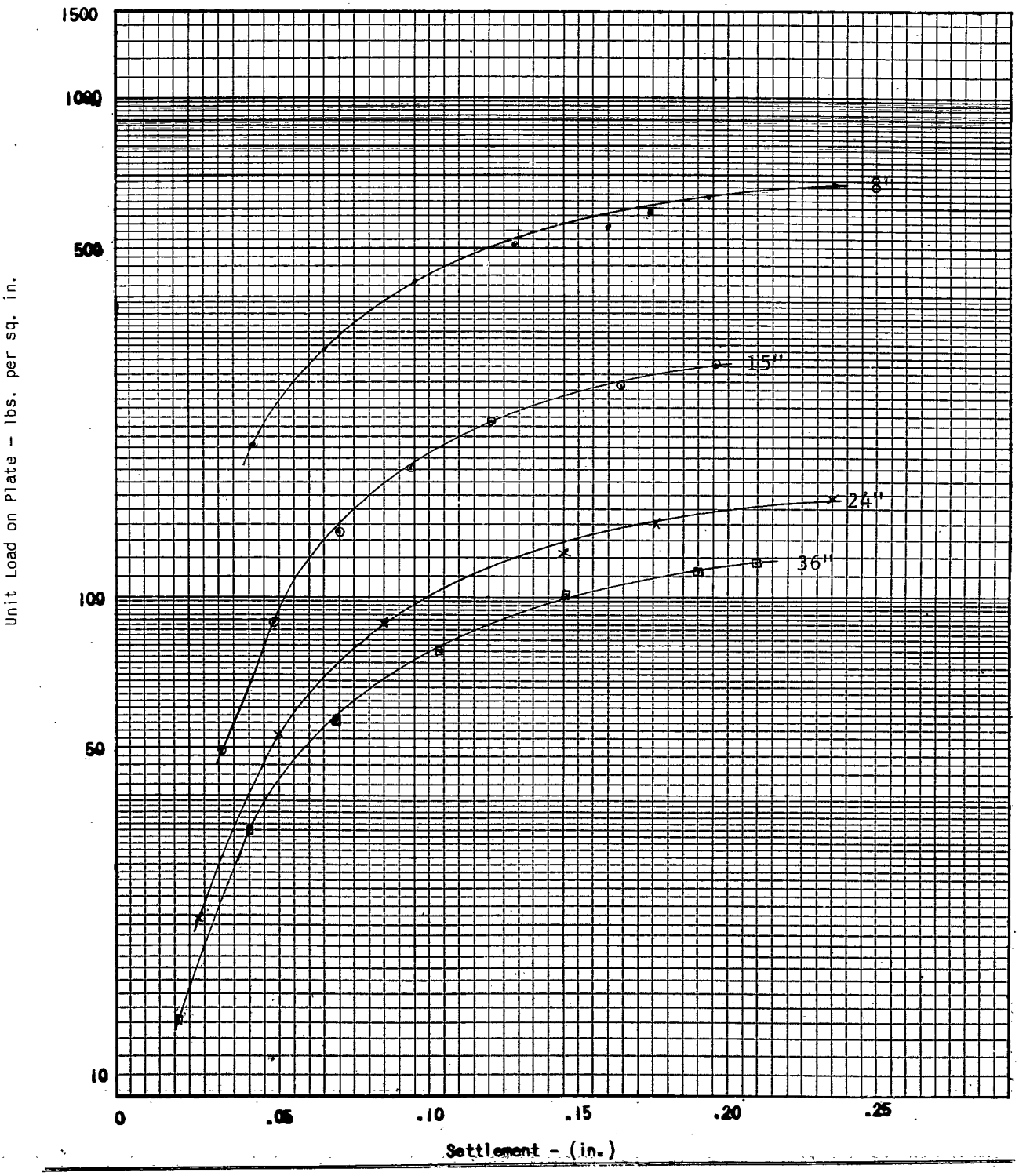
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	56+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	56+00

PLATE BEARING TEST DATA

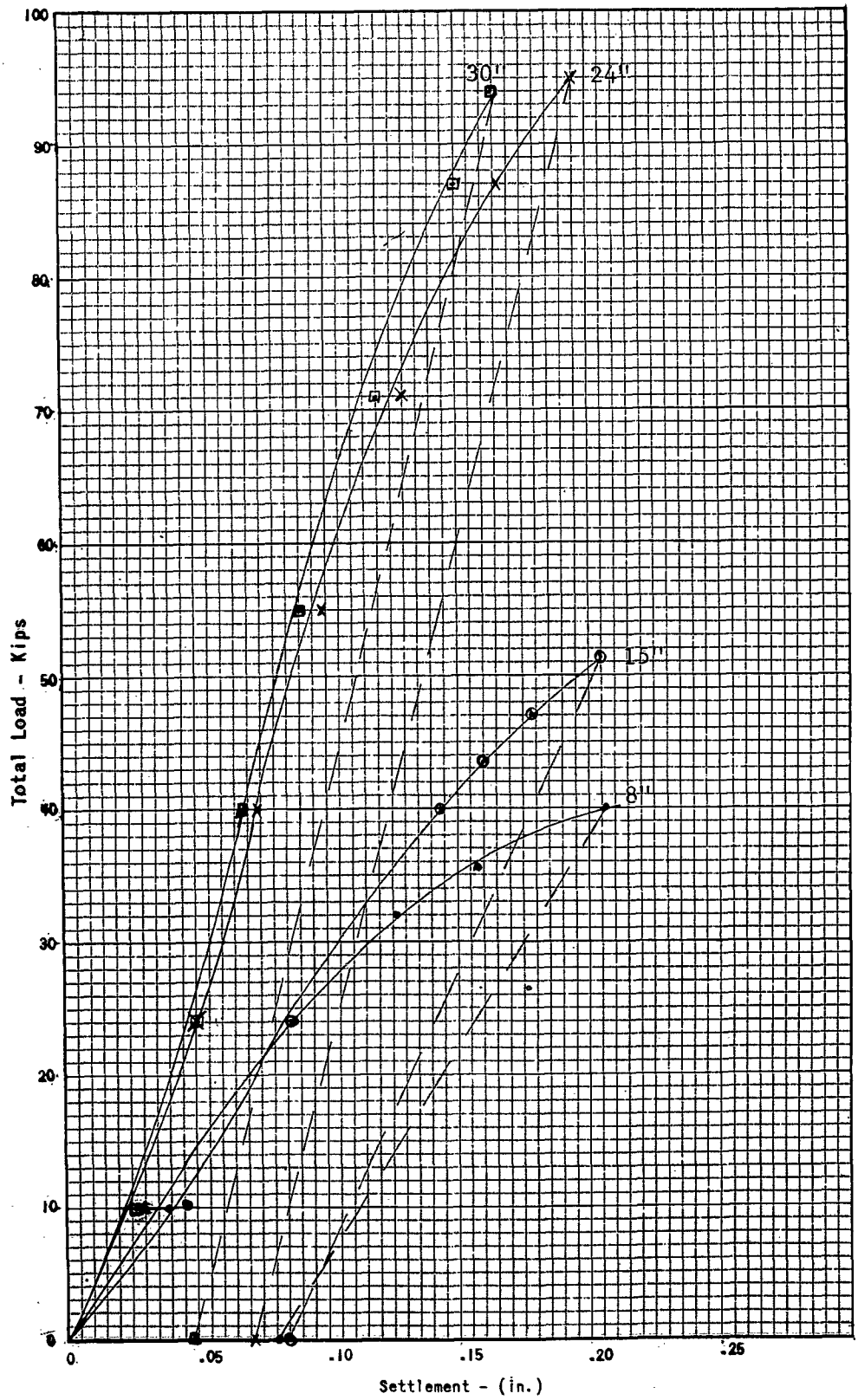
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

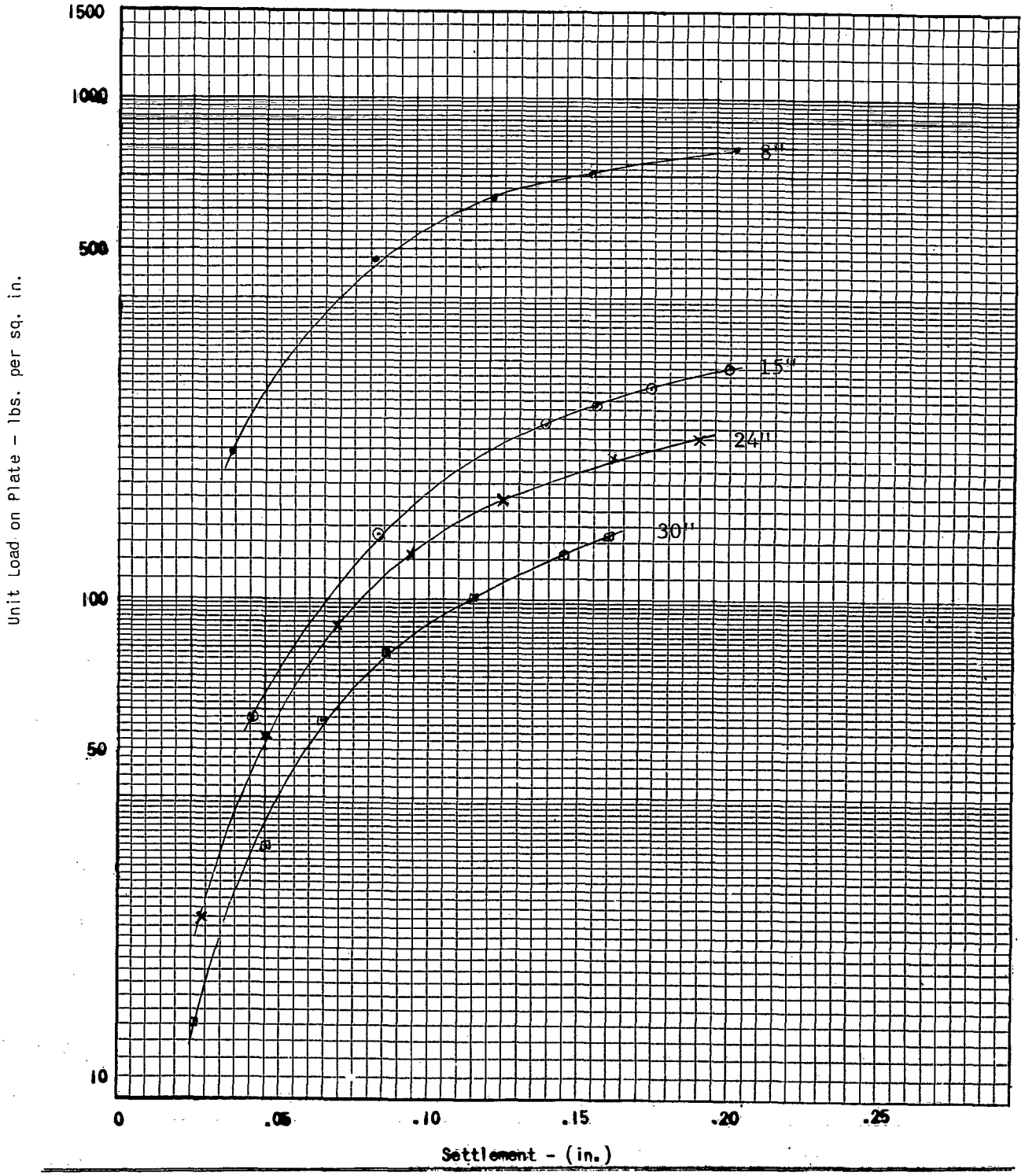
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	7+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	7+00

PLATE BEARING TEST DATA

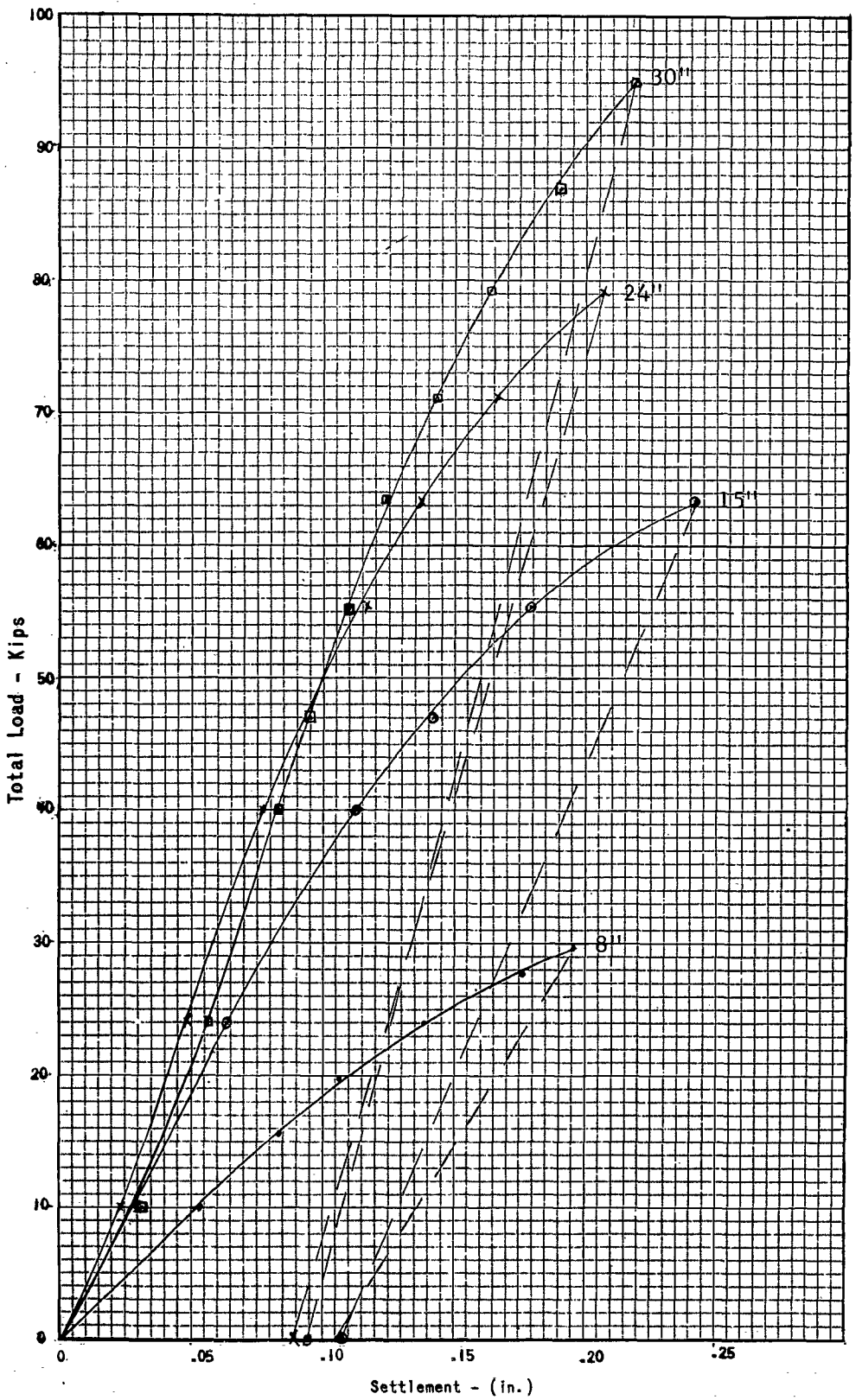
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

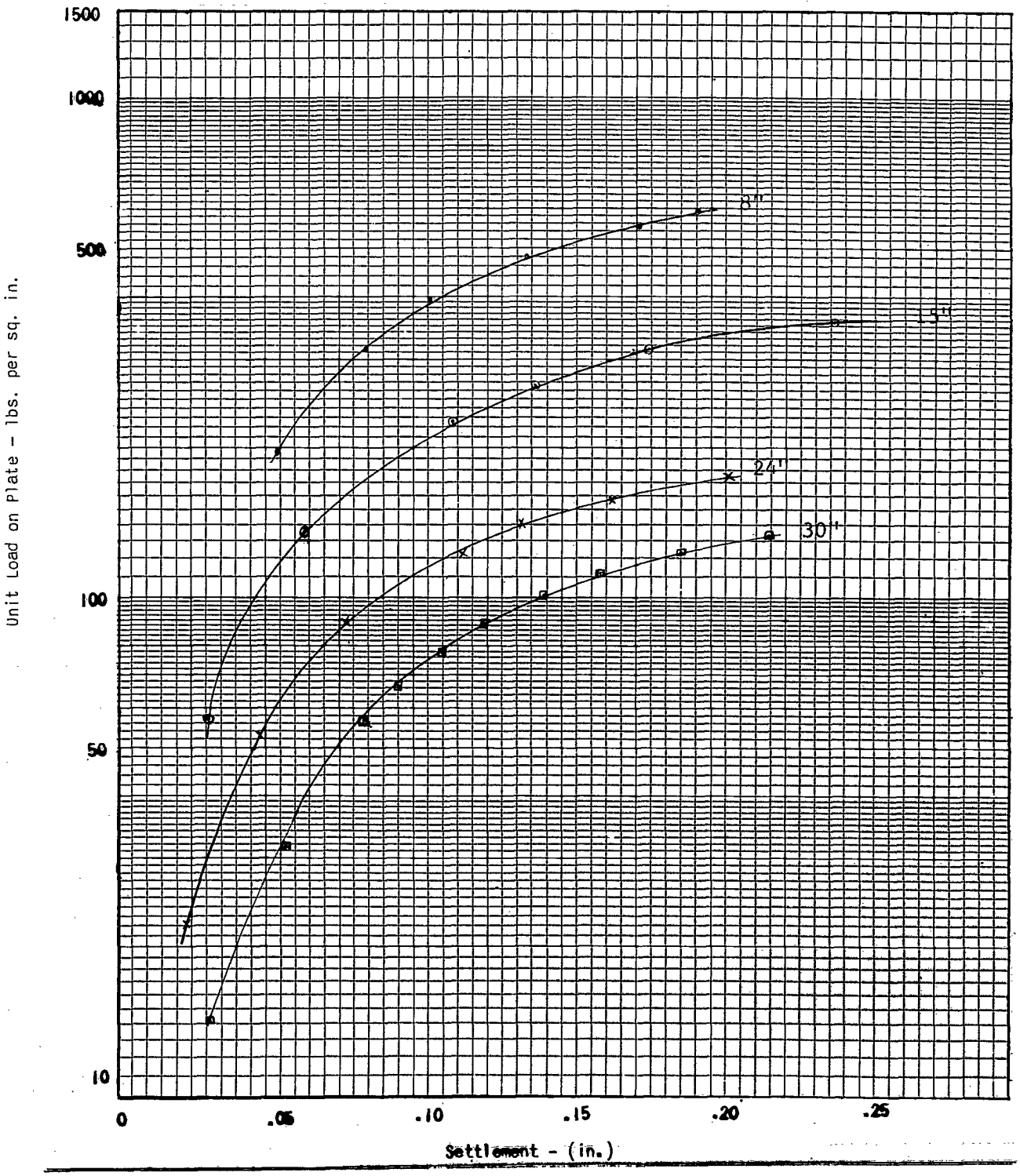
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	19+00



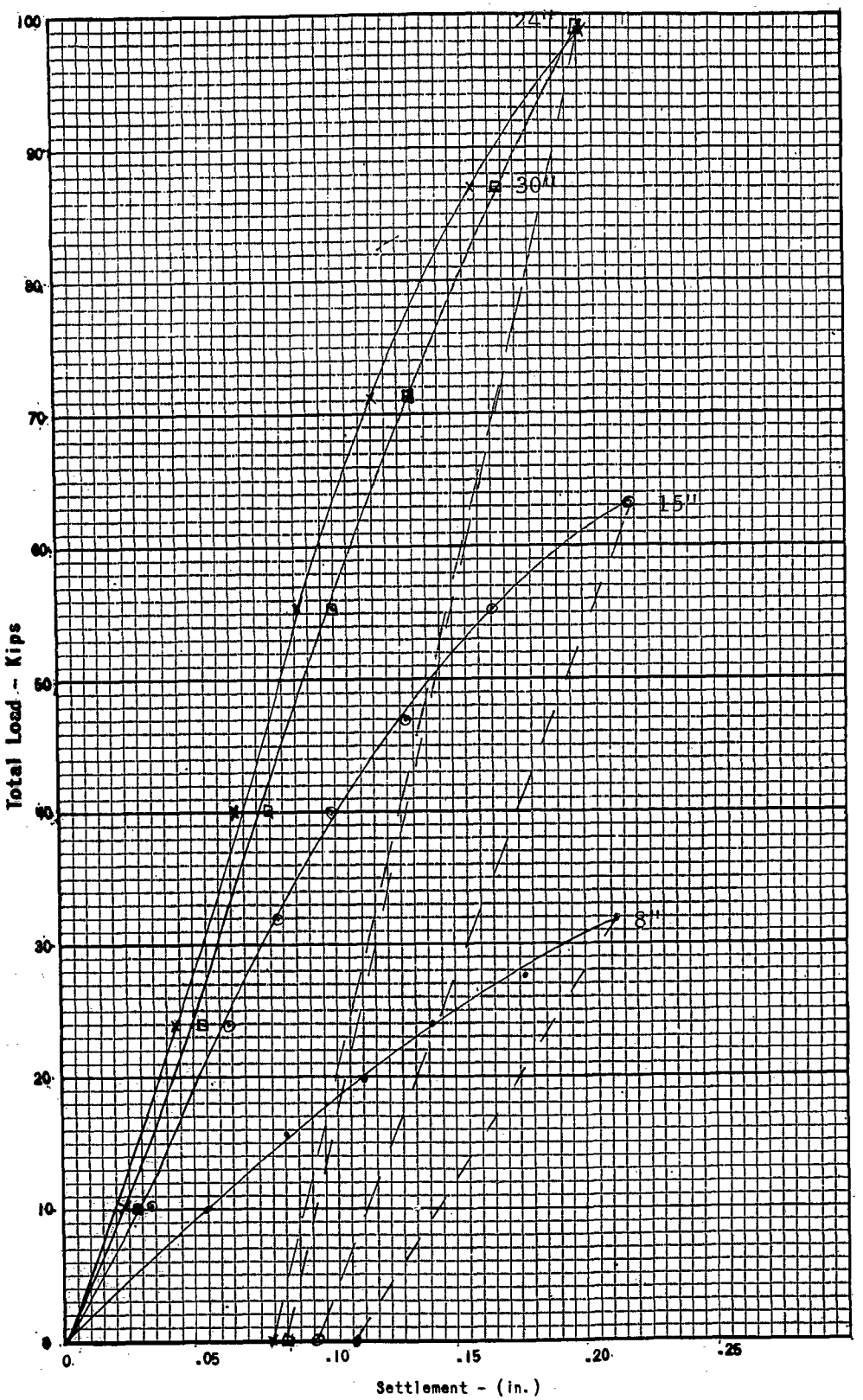
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	19+00

PLATE BEARING TEST DATA

Pressure vs. Deflection



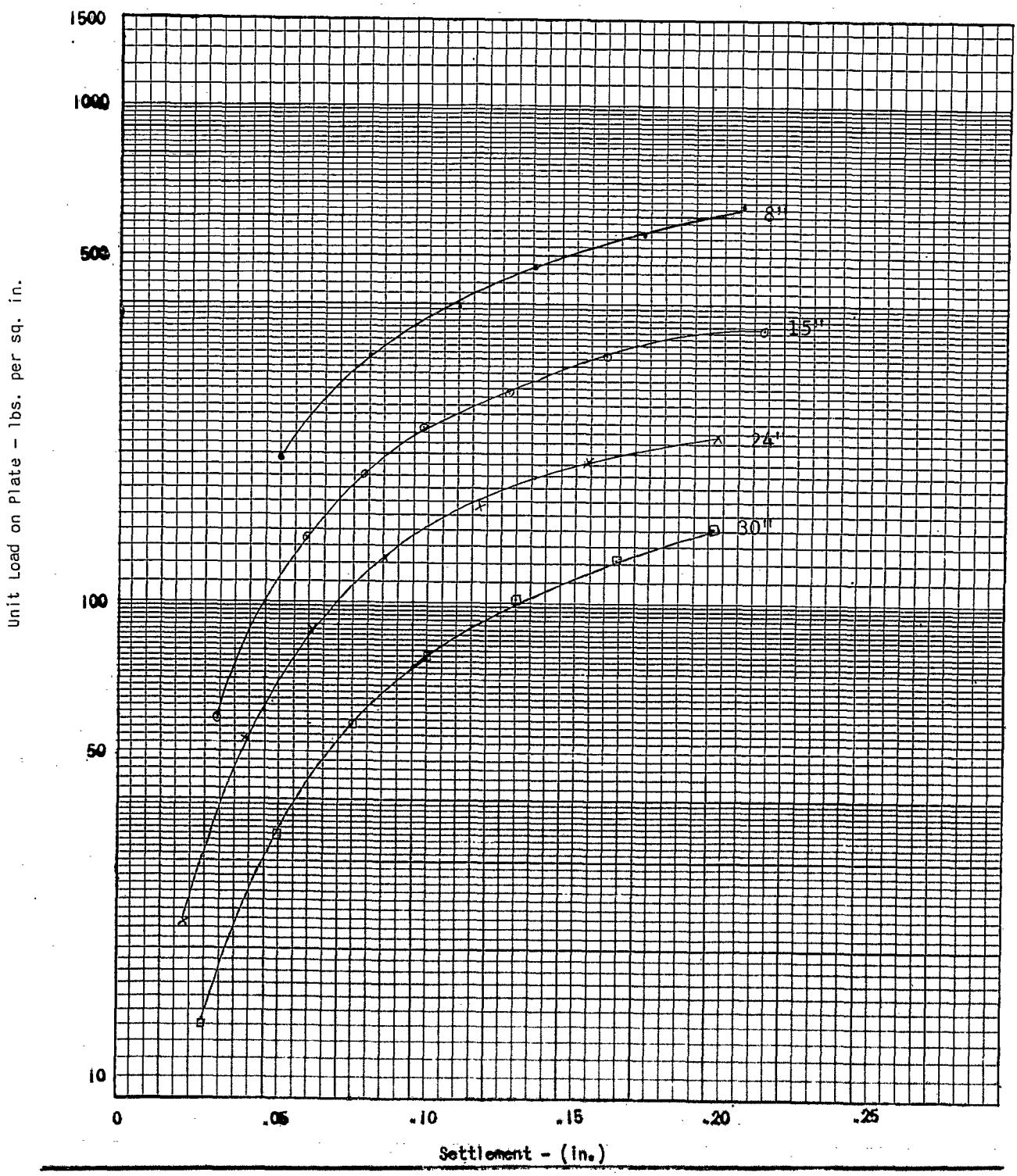
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	29+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	29+00

PLATE BEARING TEST DATA

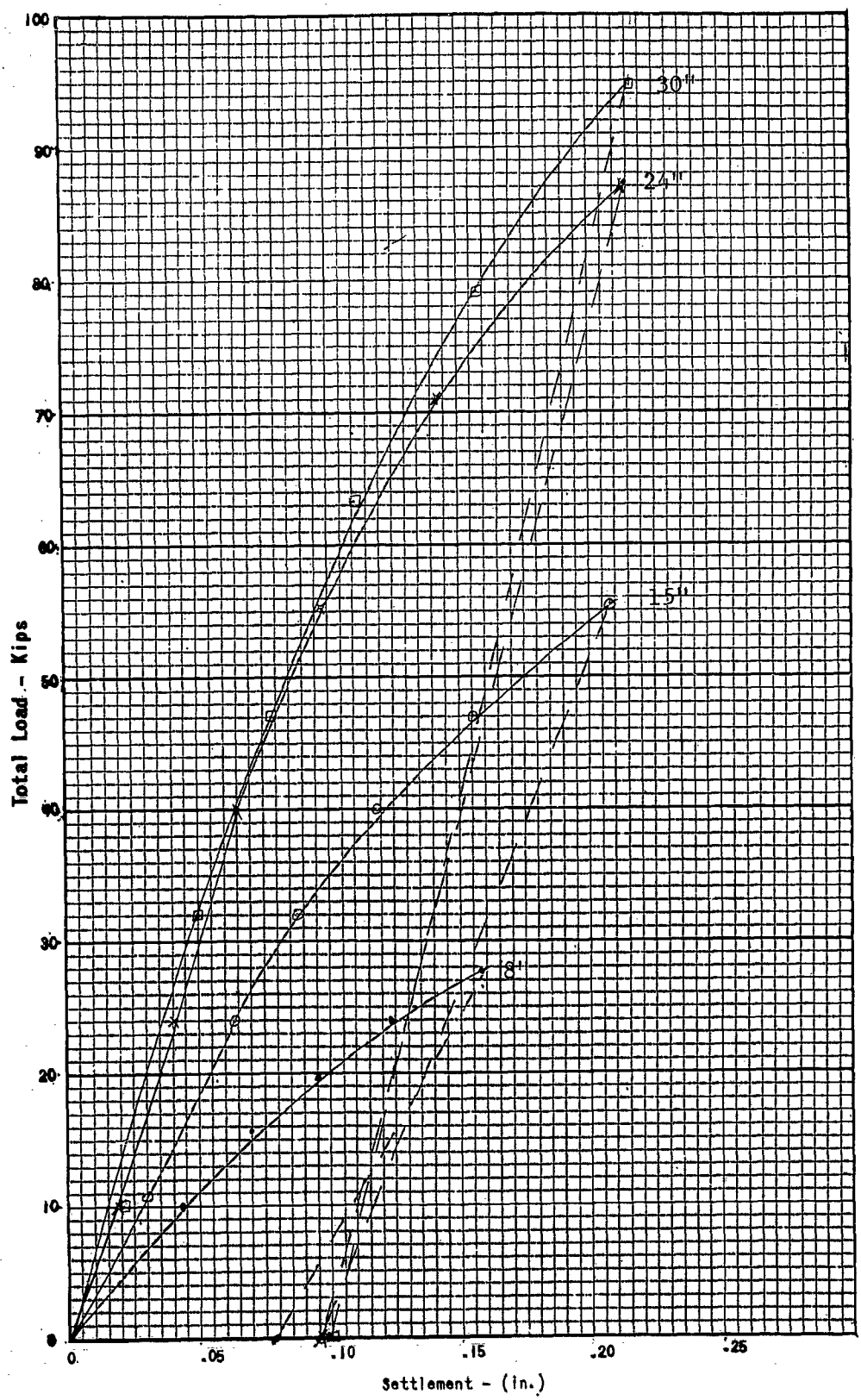
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

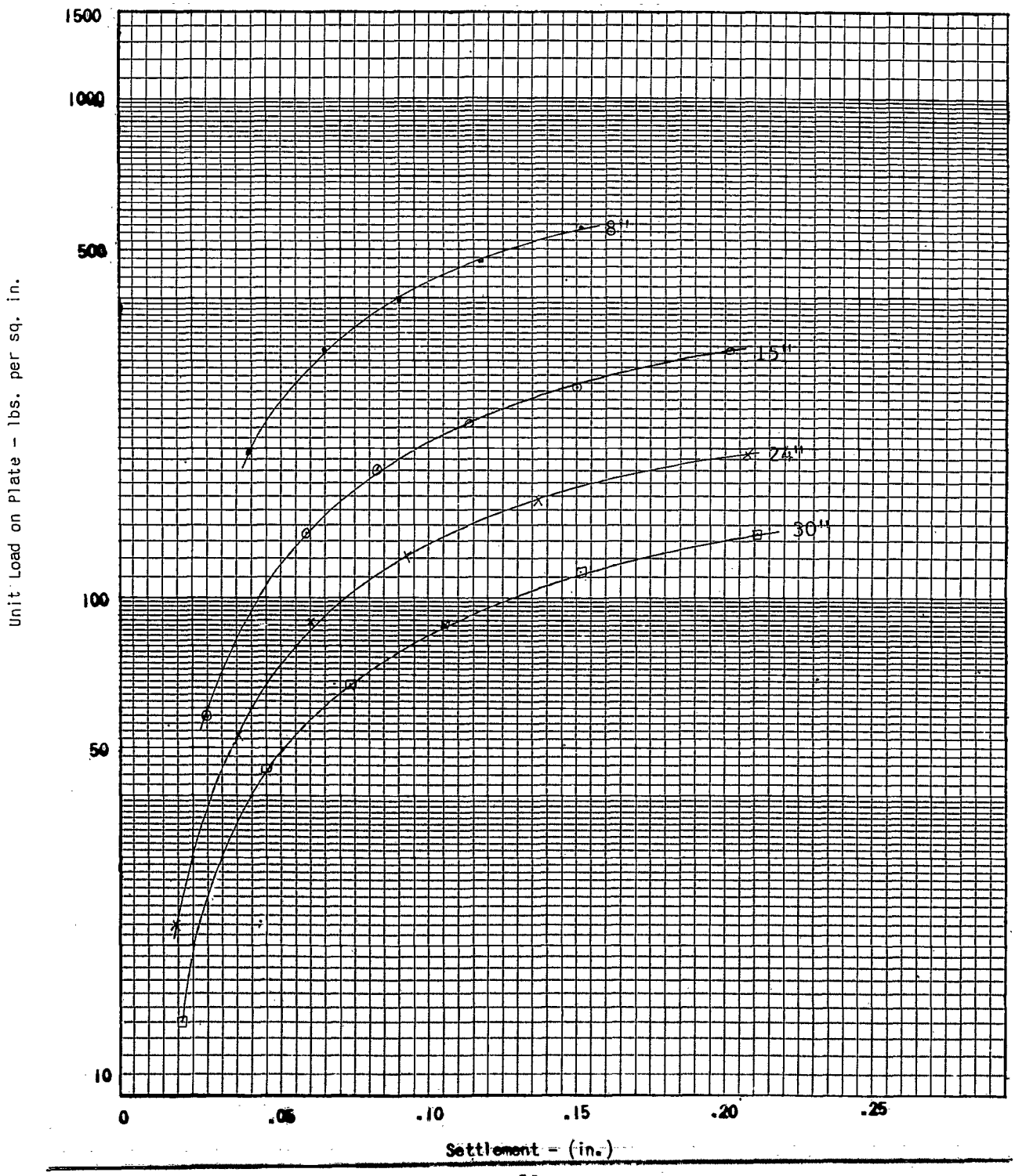
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	39+00



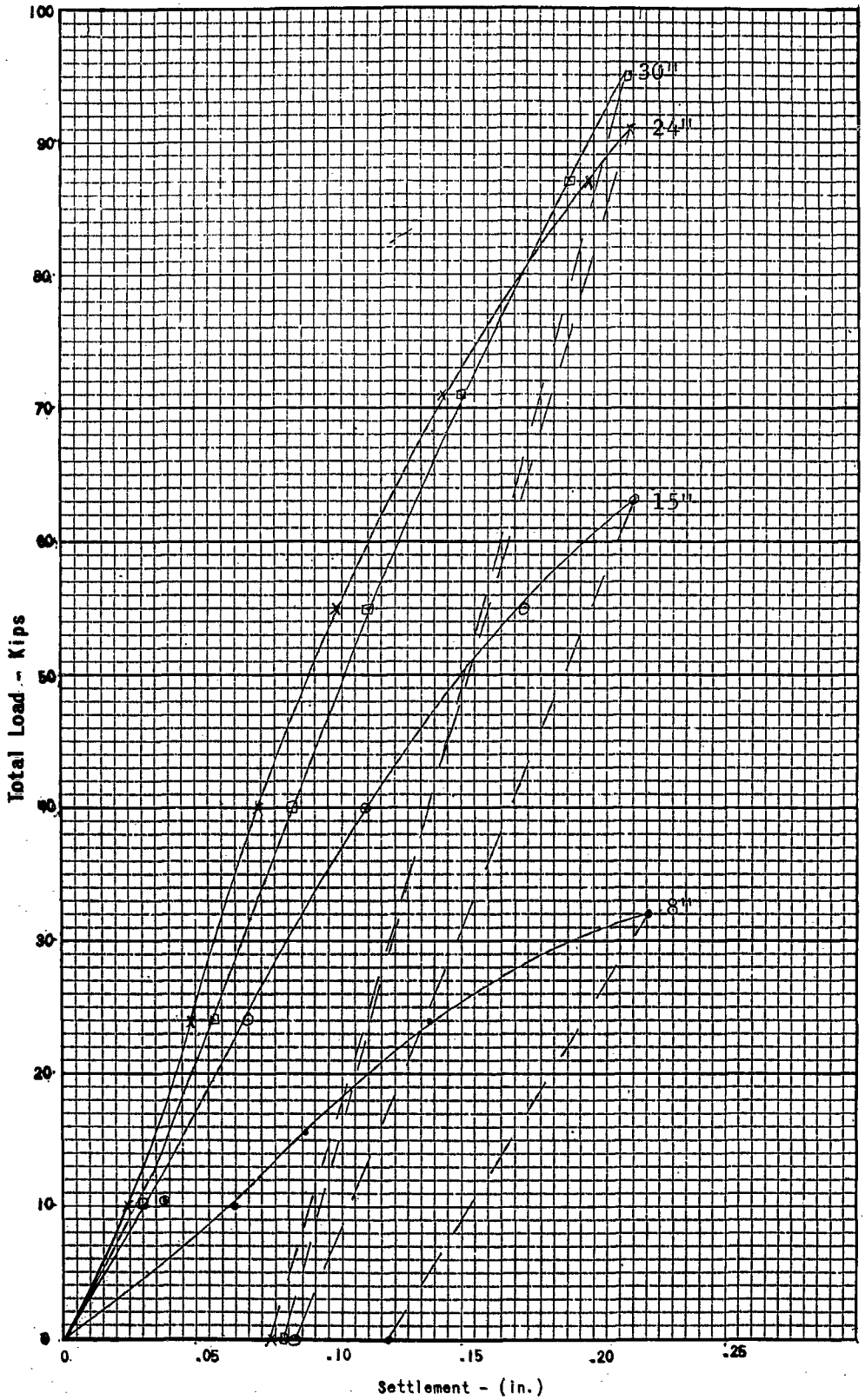
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	39+00

PLATE BEARING TEST DATA

Pressure vs. Deflection



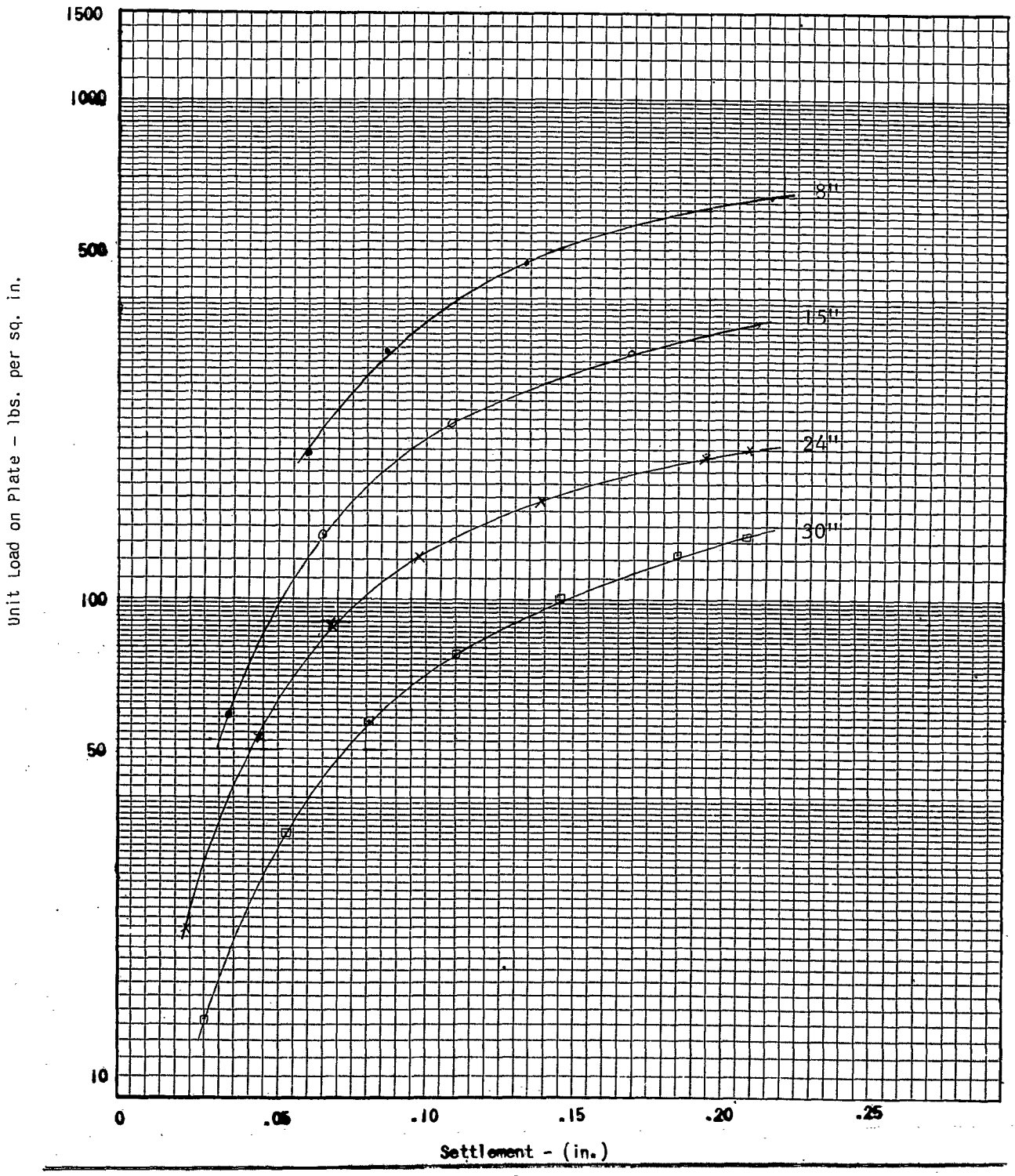
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	49+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	49+00

PLATE BEARING TEST DATA

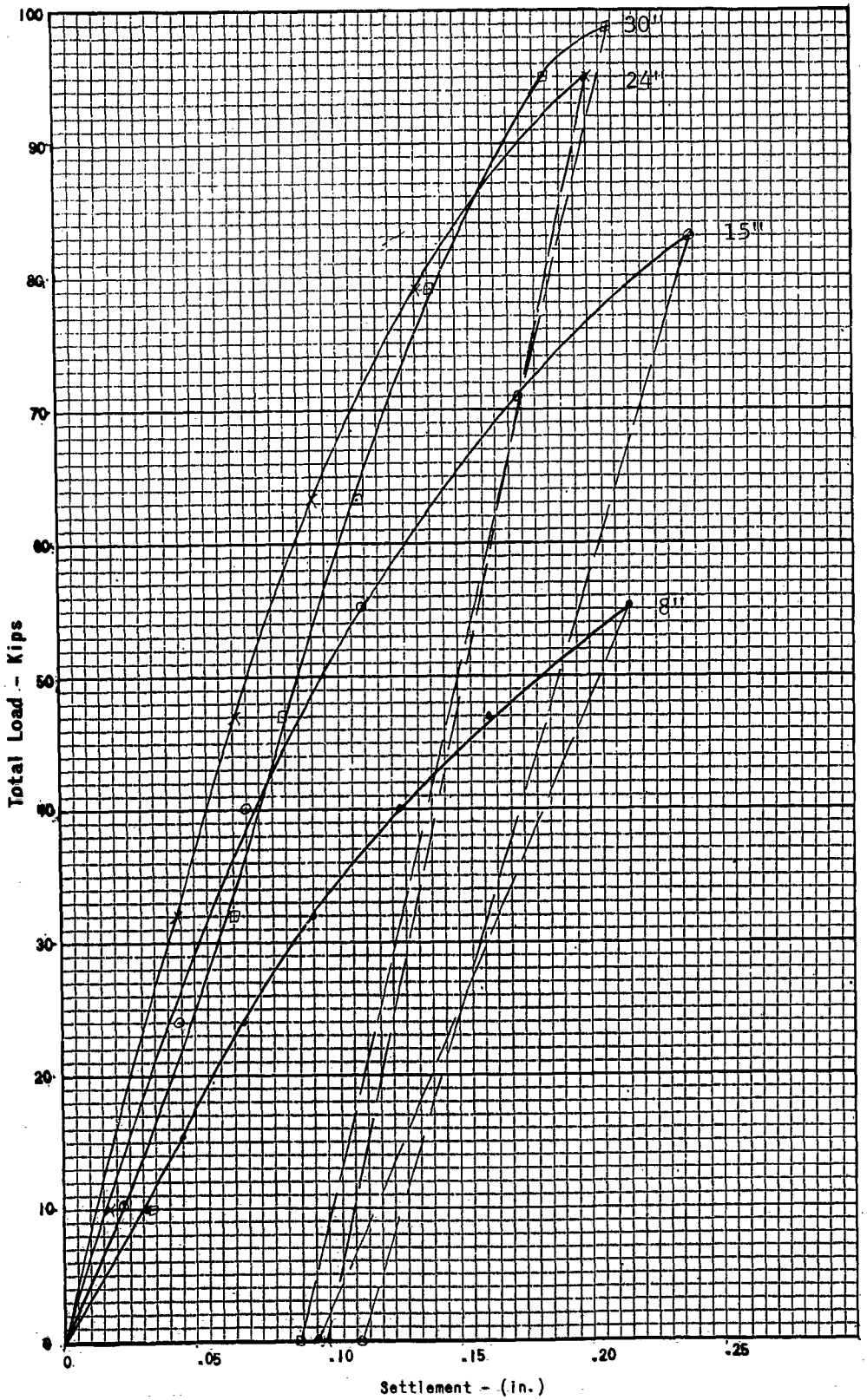
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

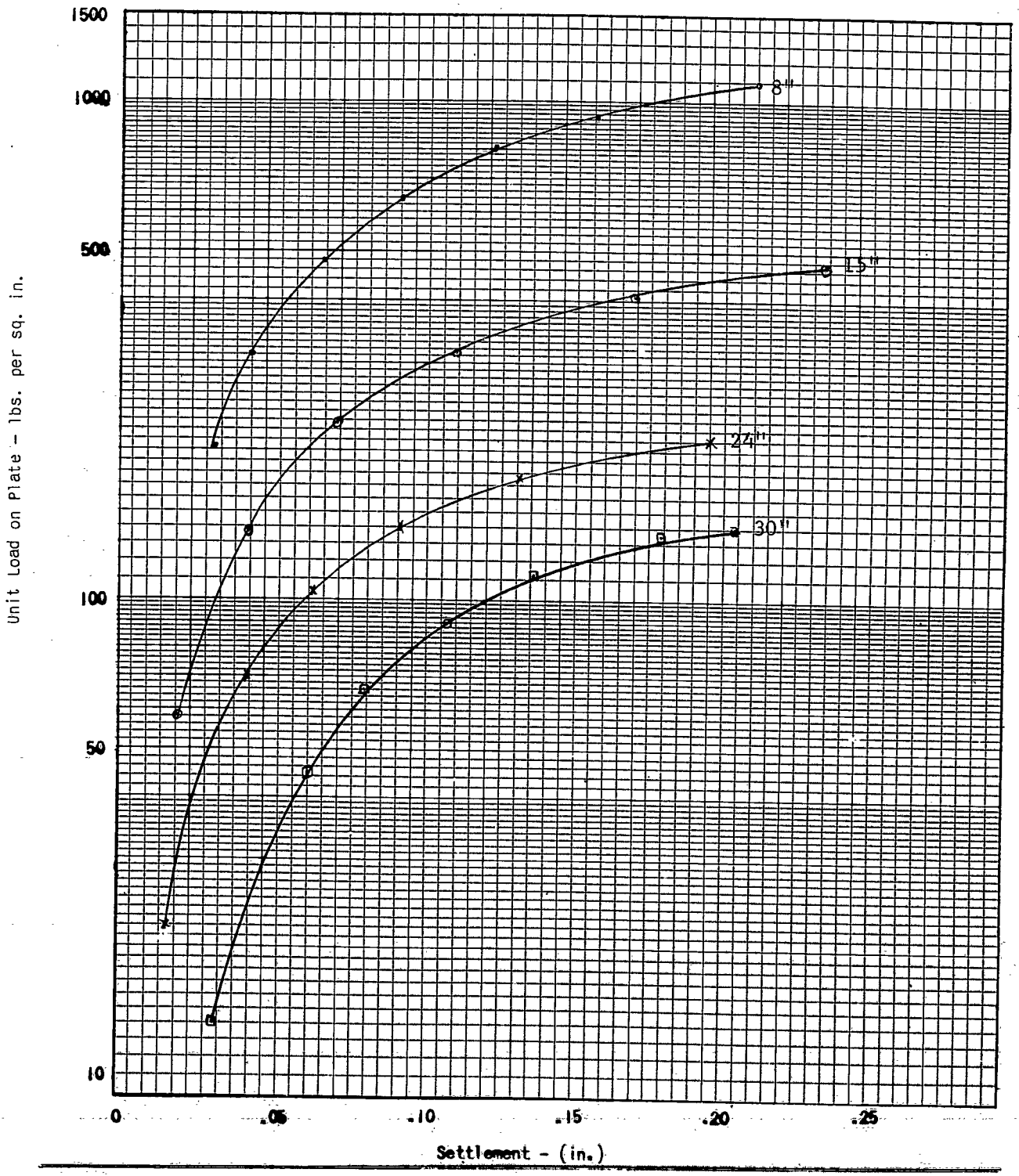
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	12+00



FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	12+00

PLATE BEARING TEST DATA

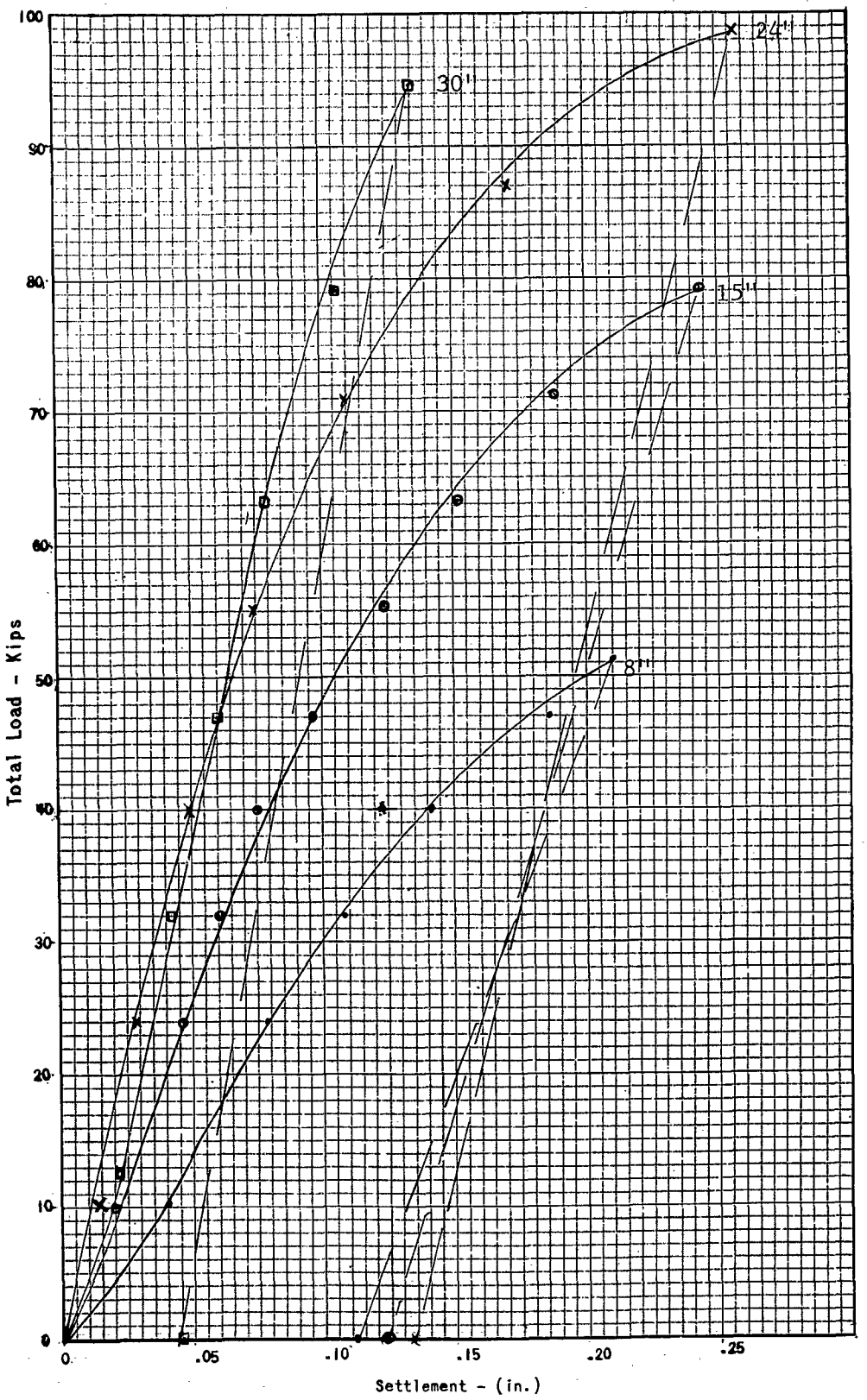
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	22+00

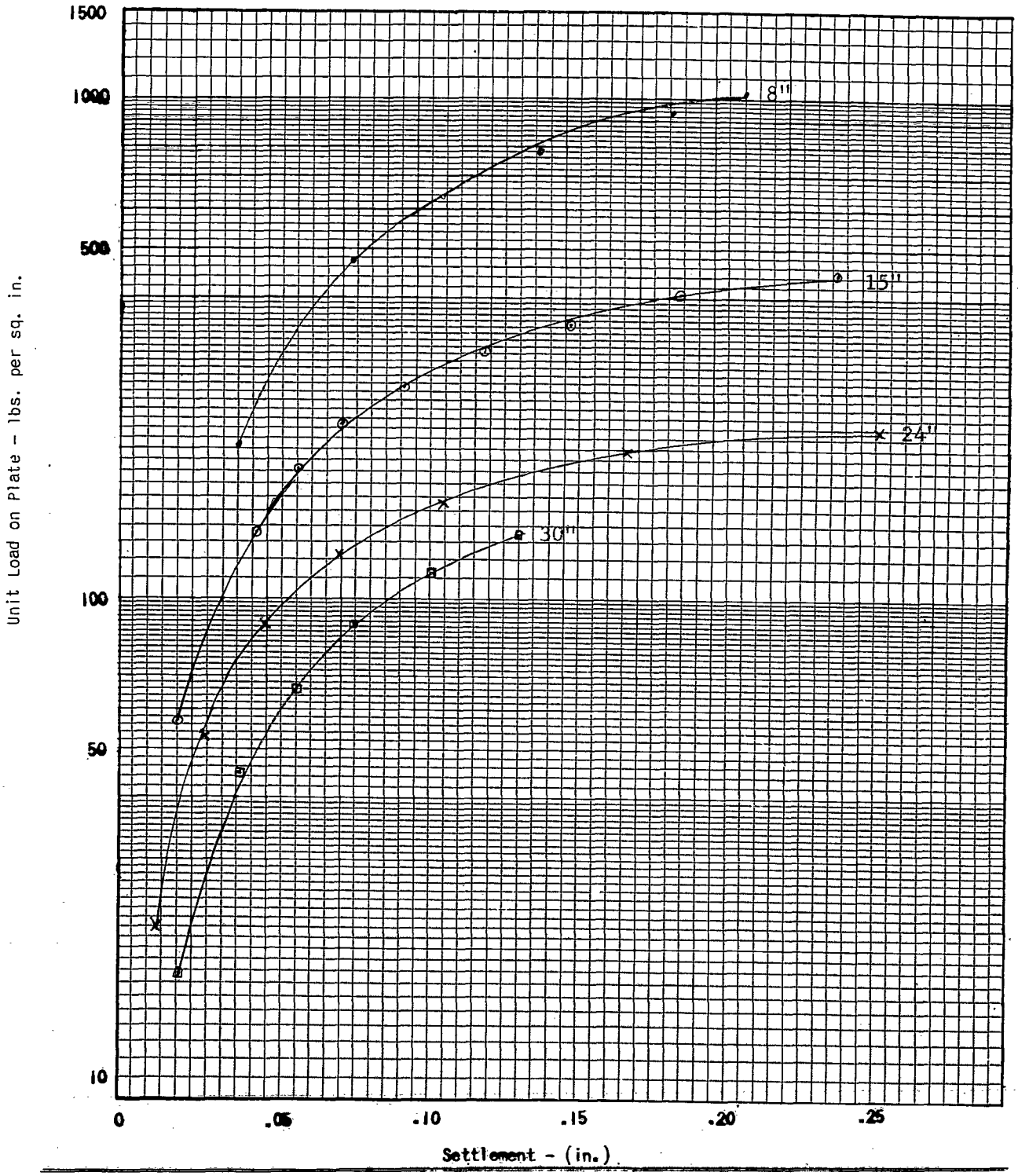


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	22+00

PLATE BEARING TEST DATA

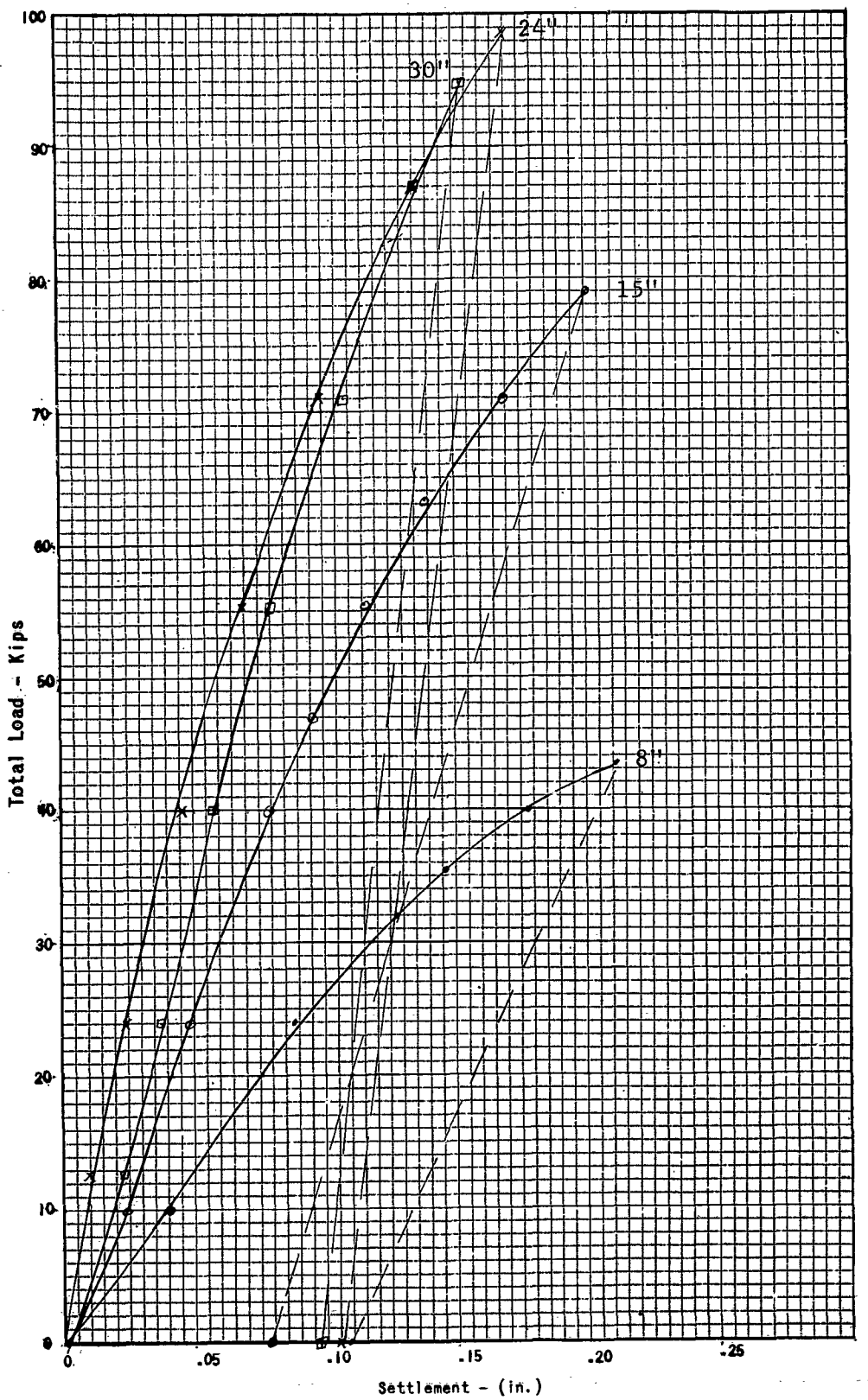
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	32+00

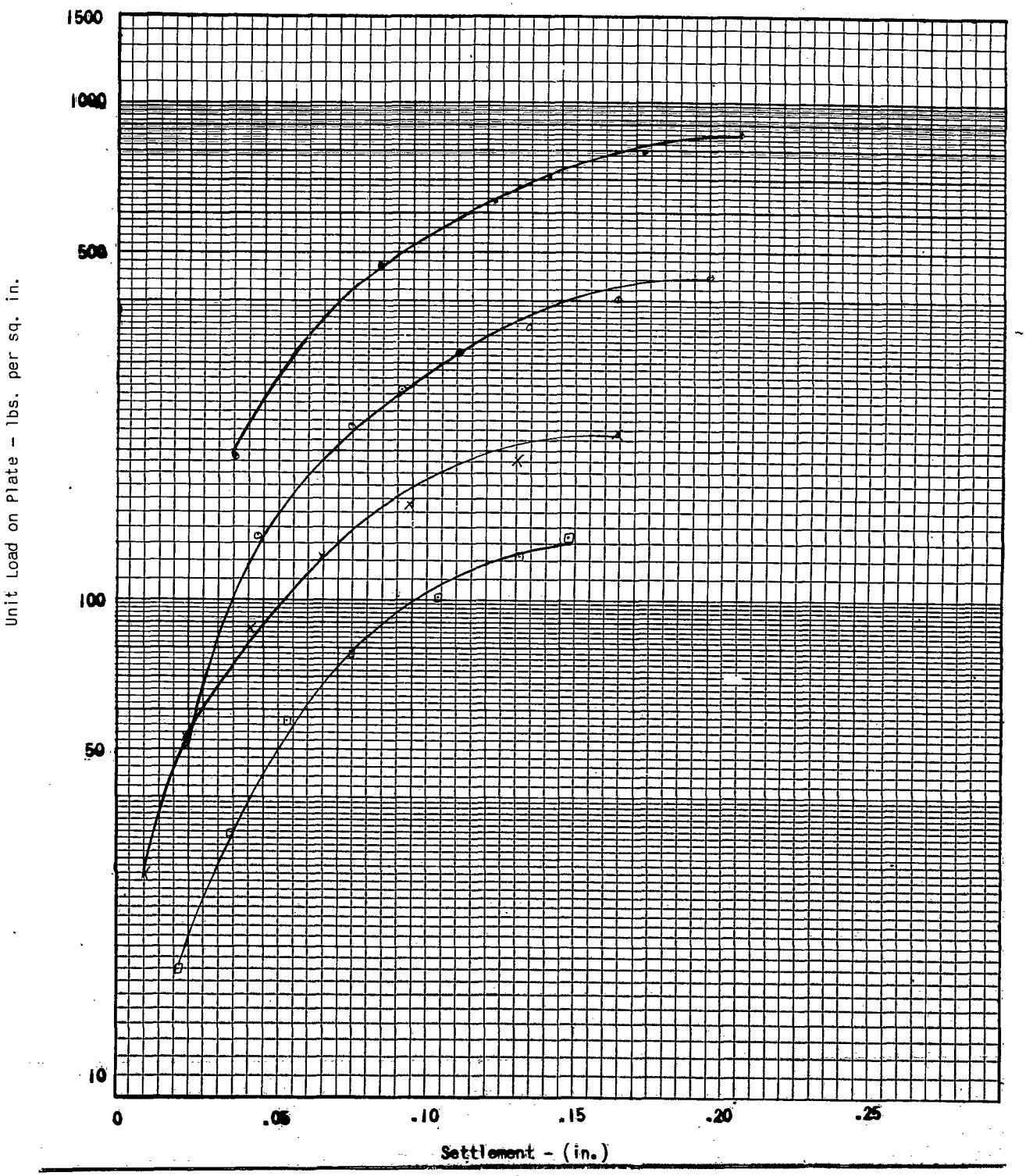


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	32+00

PLATE BEARING TEST DATA

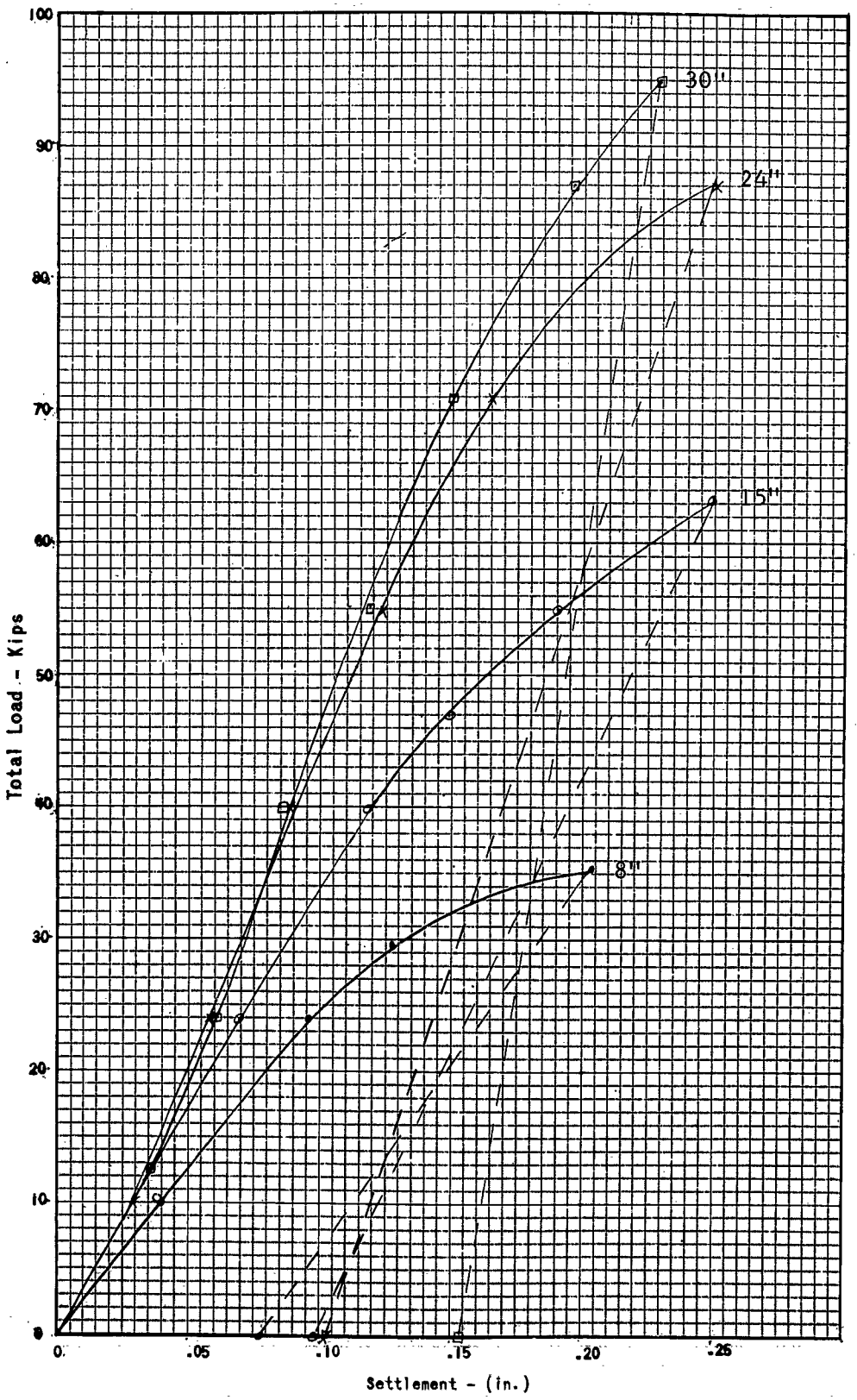
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	41+00

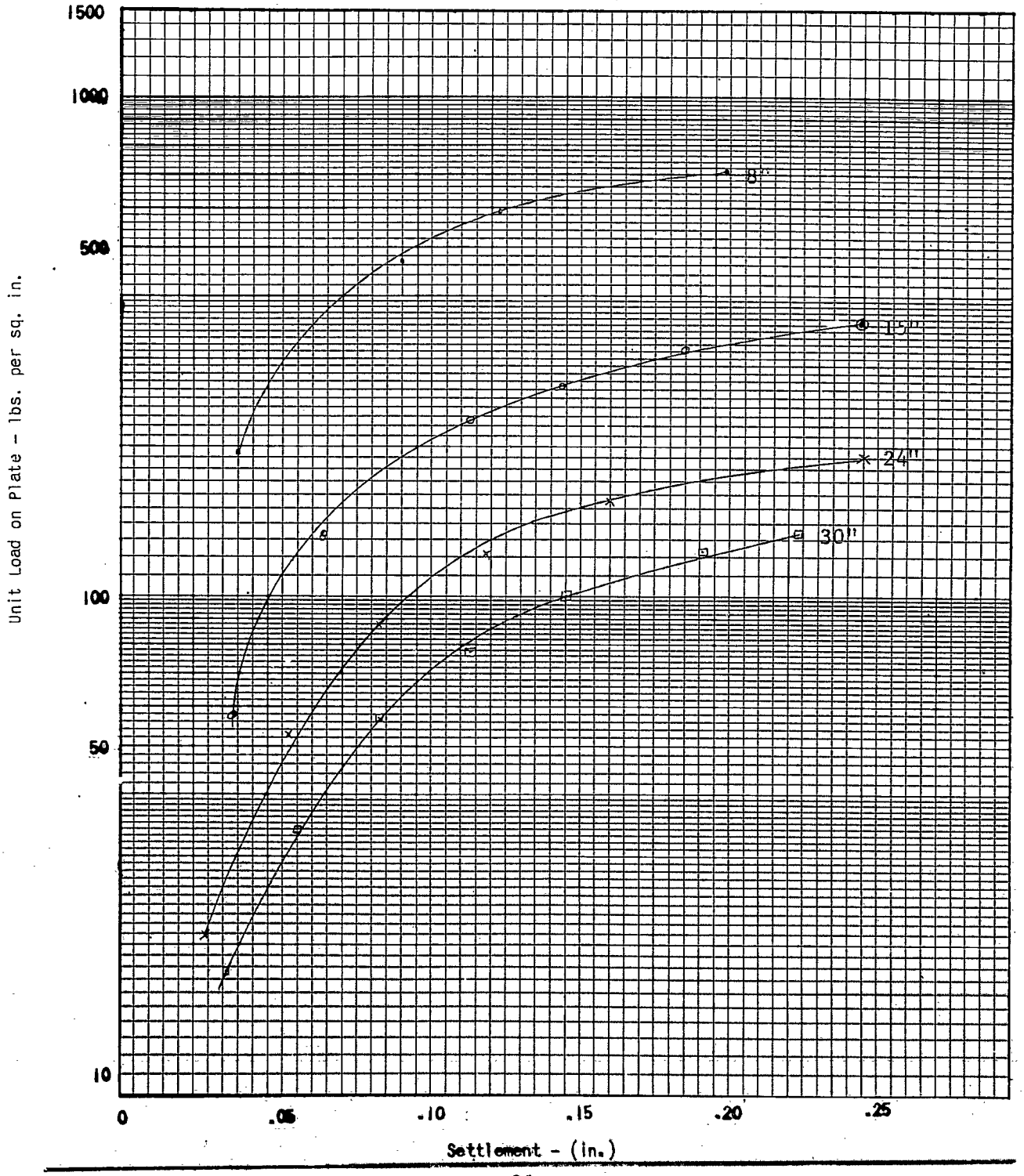


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway T-1	41+00

PLATE BEARING TEST DATA

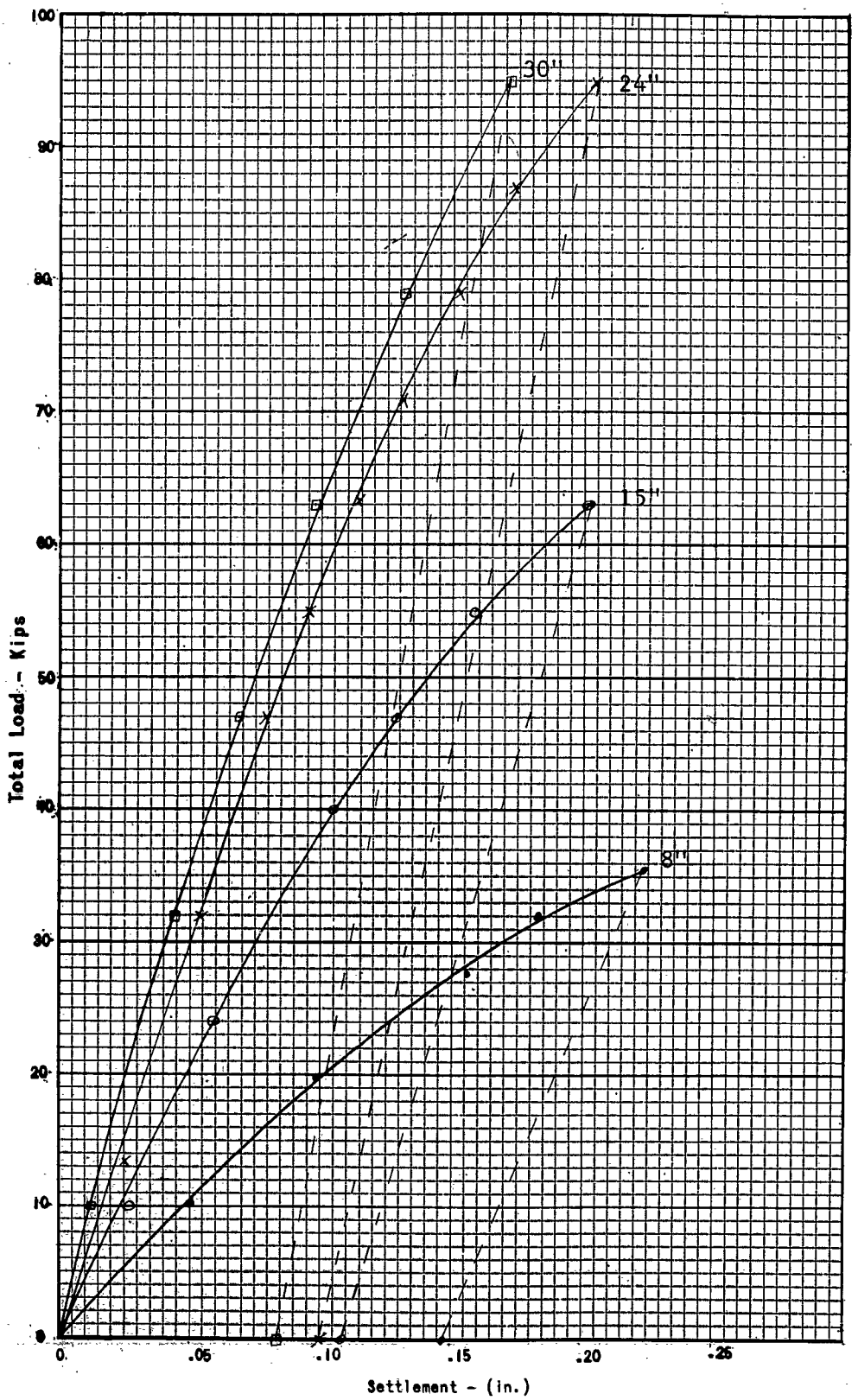
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-A	5+00

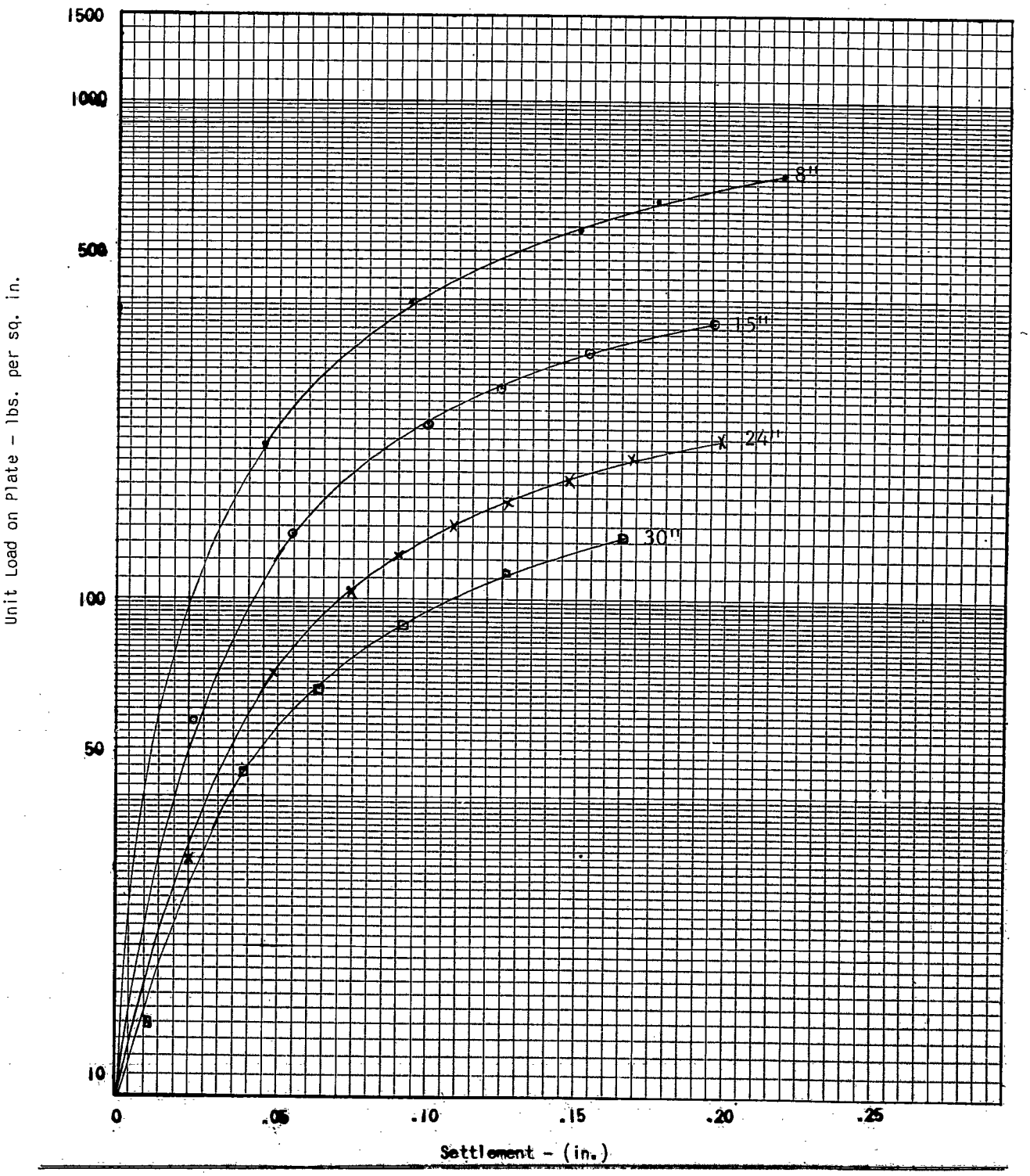


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-A	5+00

PLATE BEARING TEST DATA

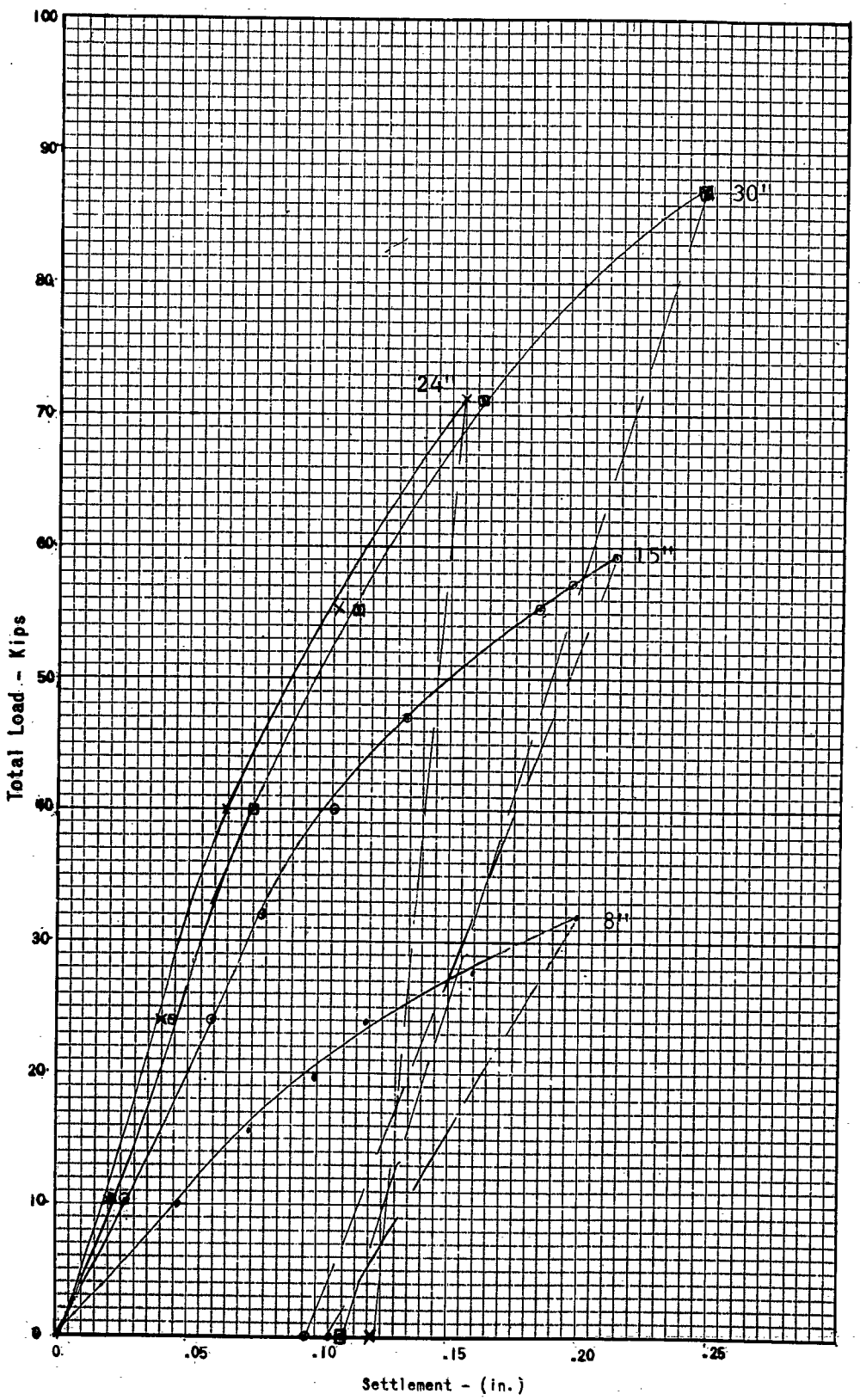
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-B	-2+00

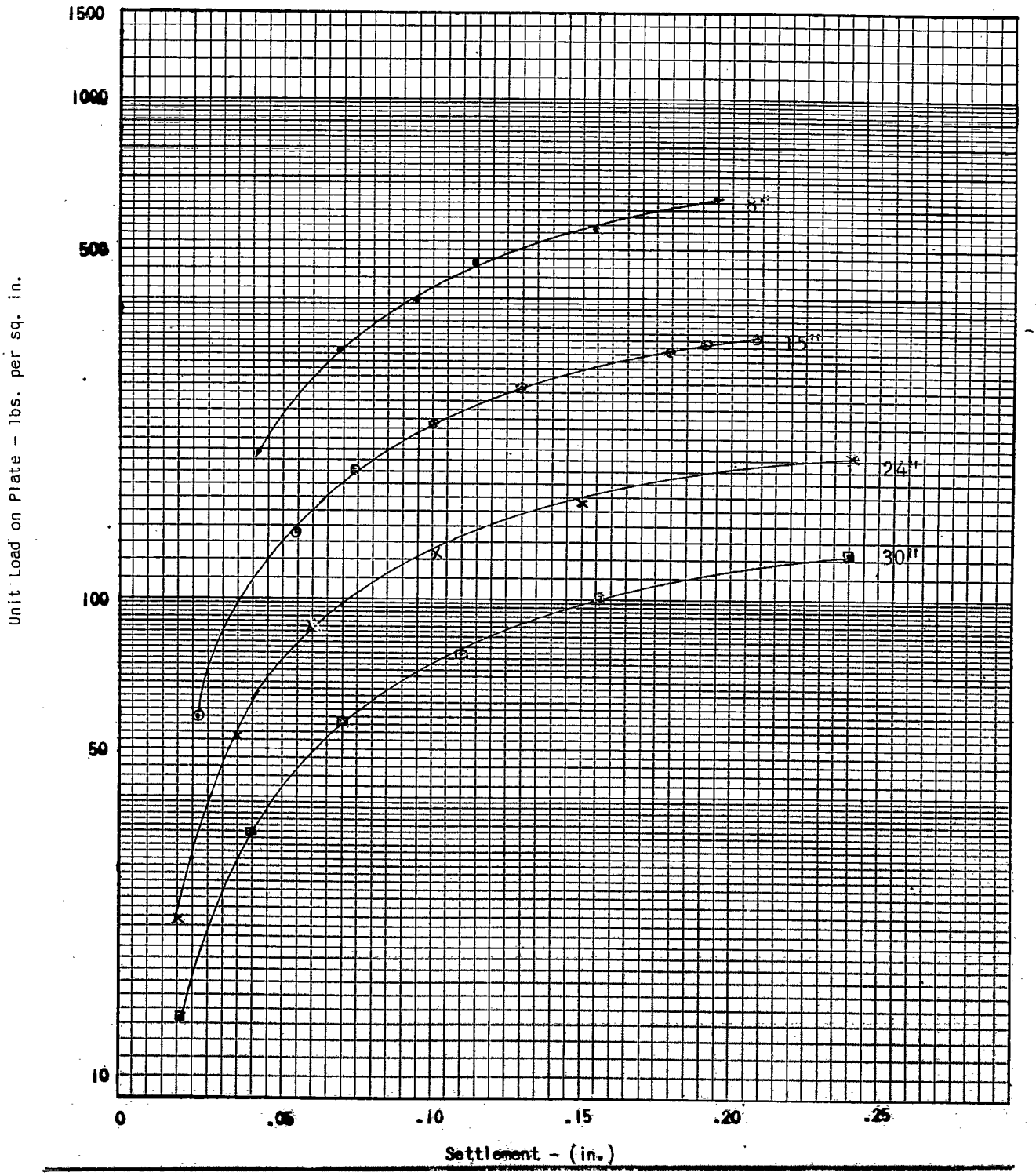


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-B	-2+00

PLATE BEARING TEST DATA

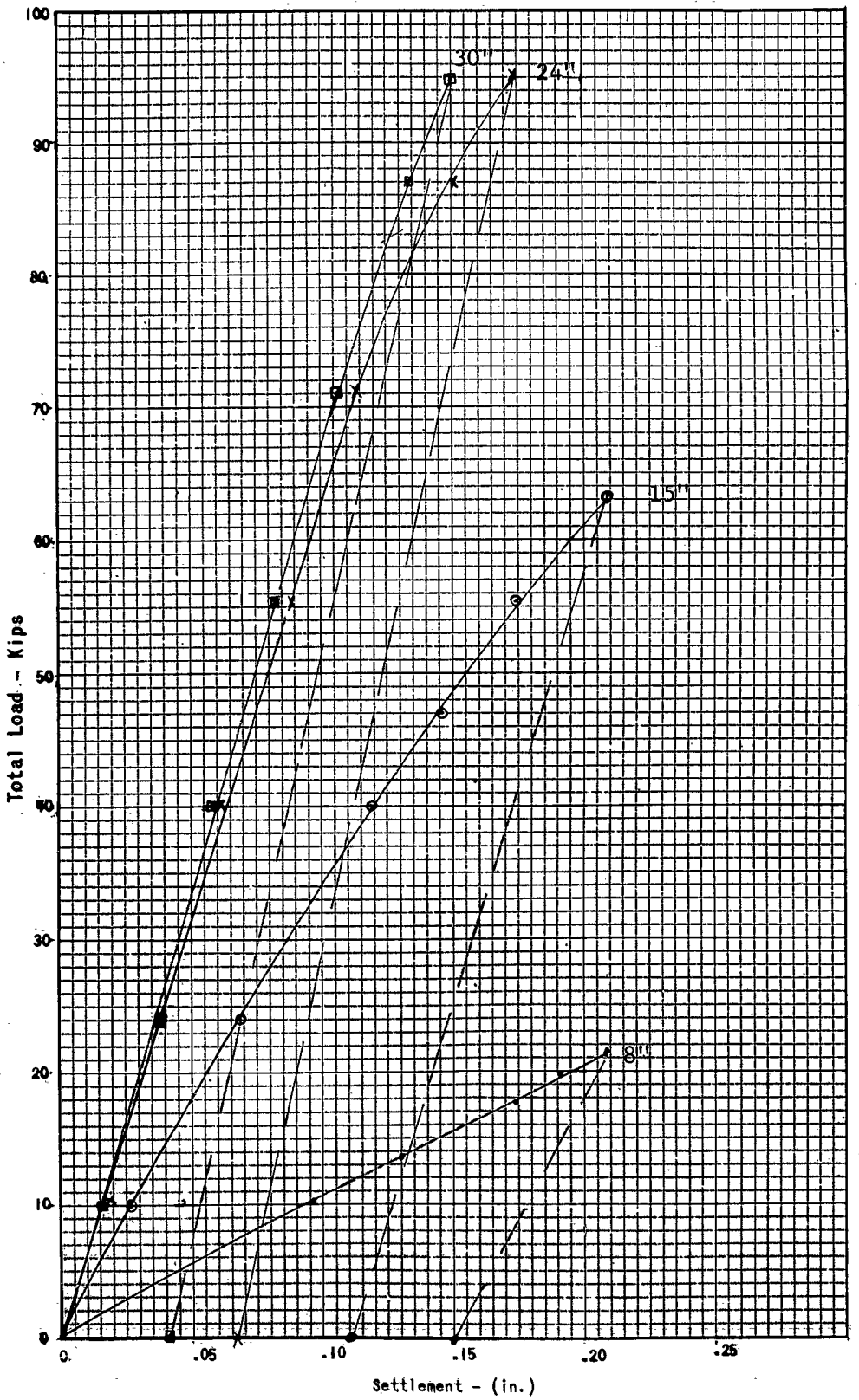
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	2+00

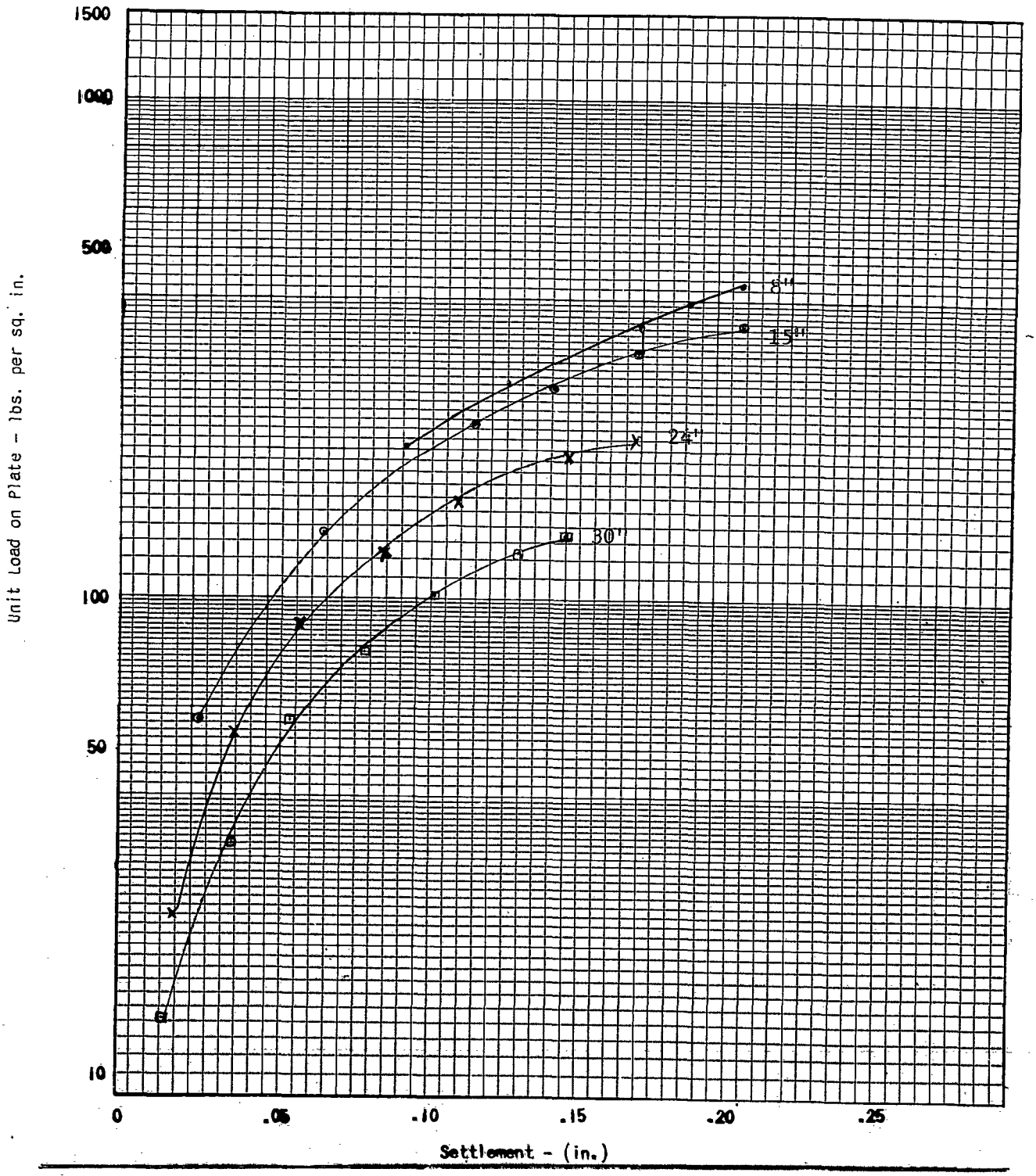


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	2+00

PLATE BEARING TEST DATA

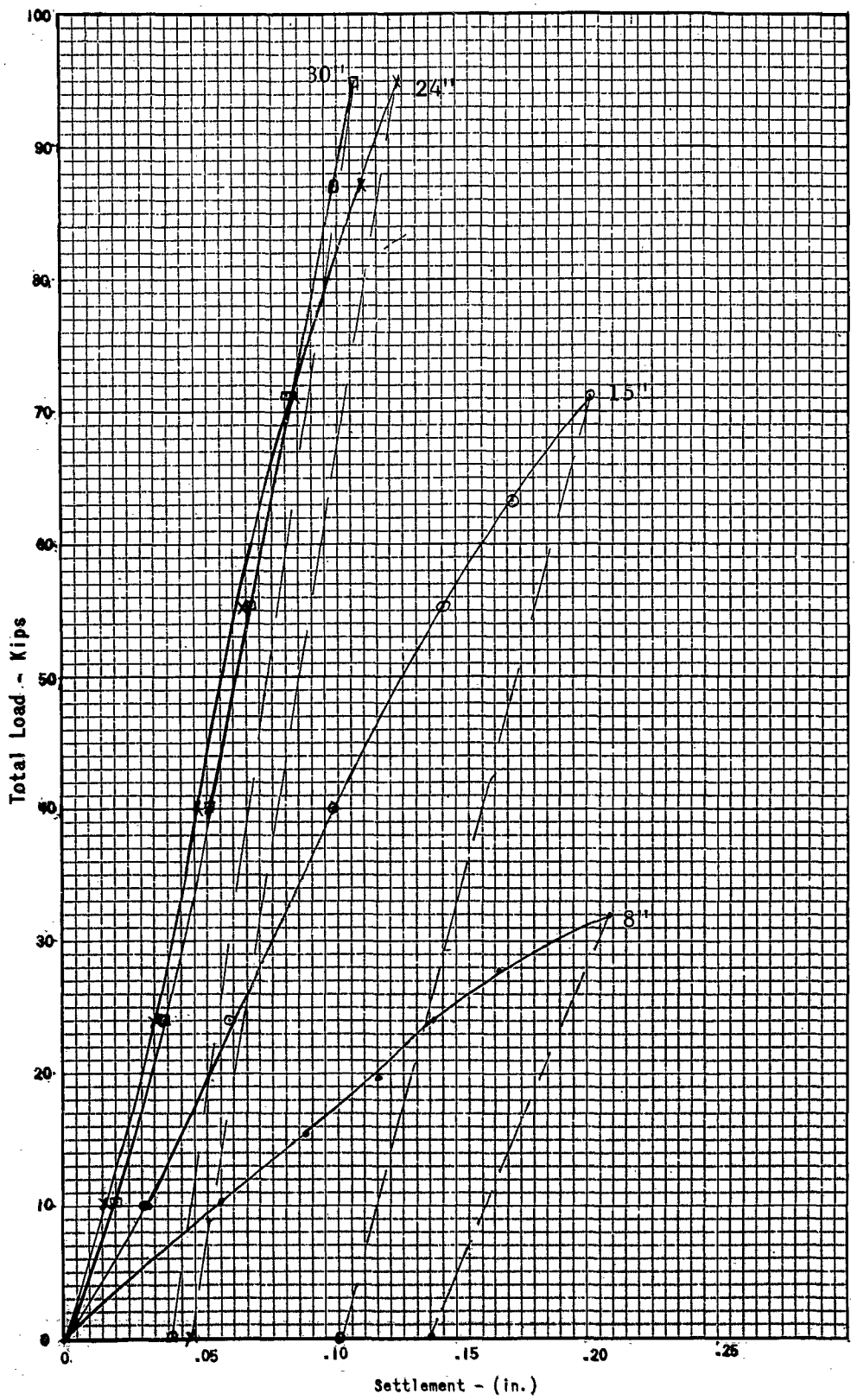
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	9+00

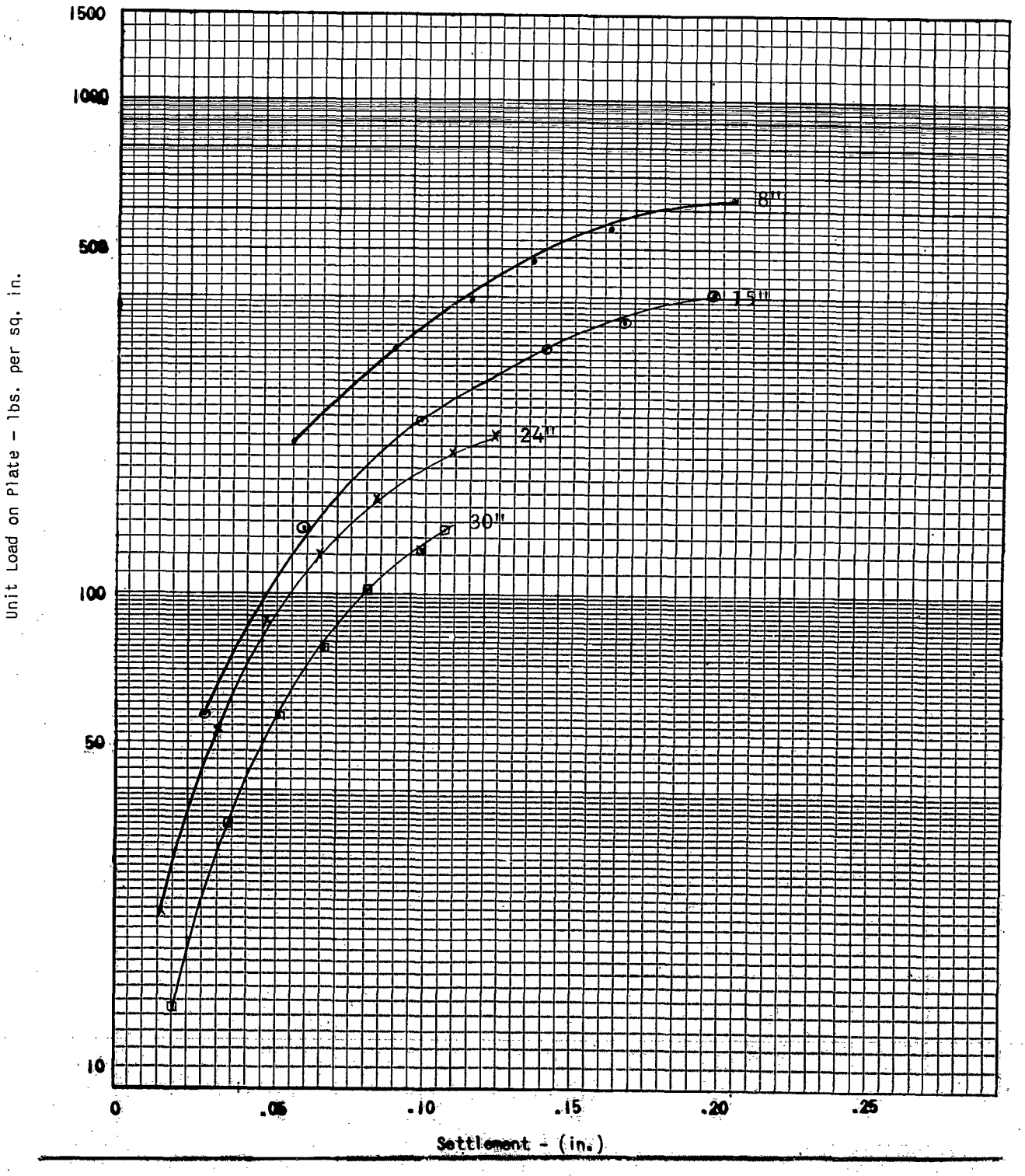


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	9+00

PLATE BEARING TEST DATA

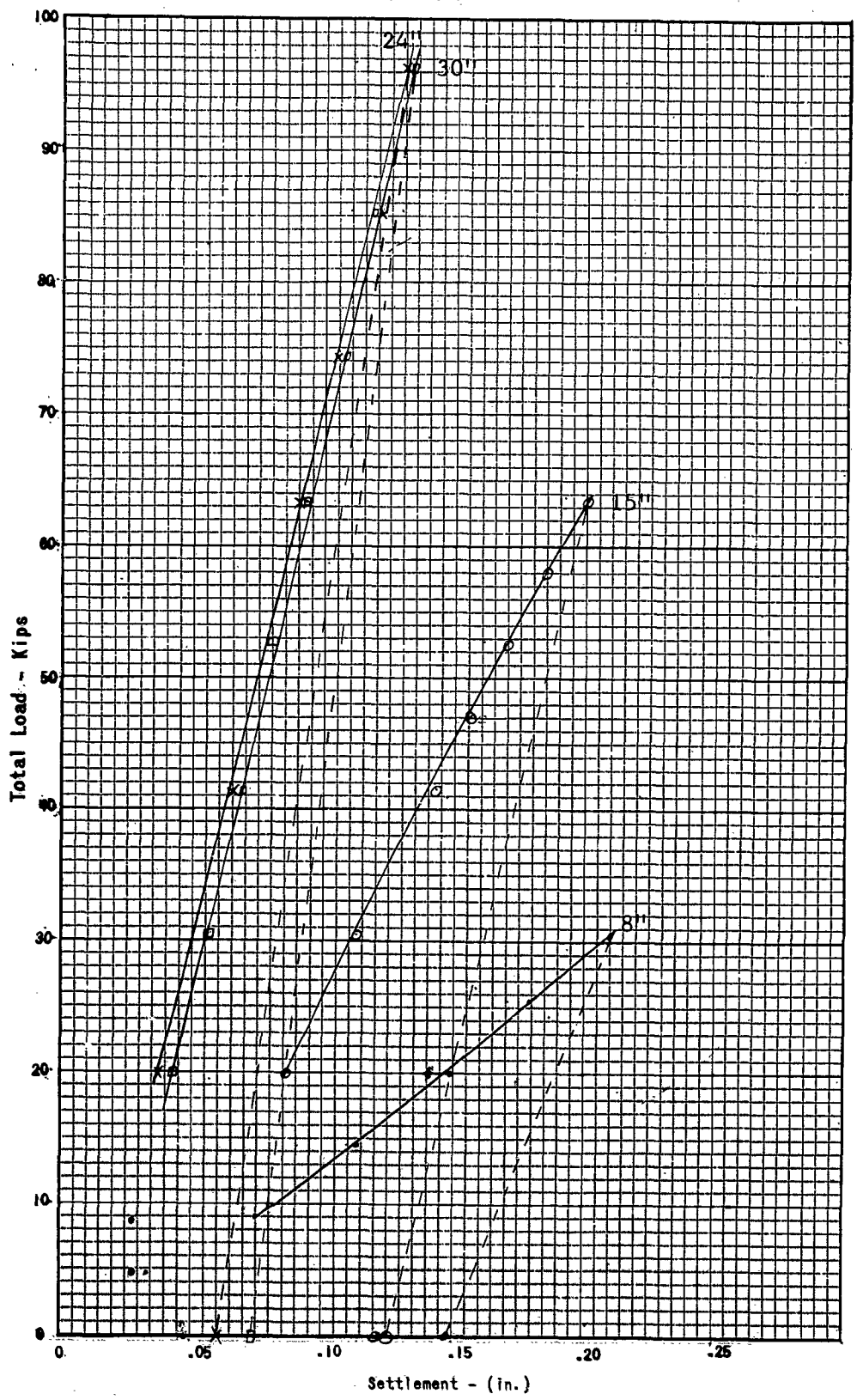
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	6+00

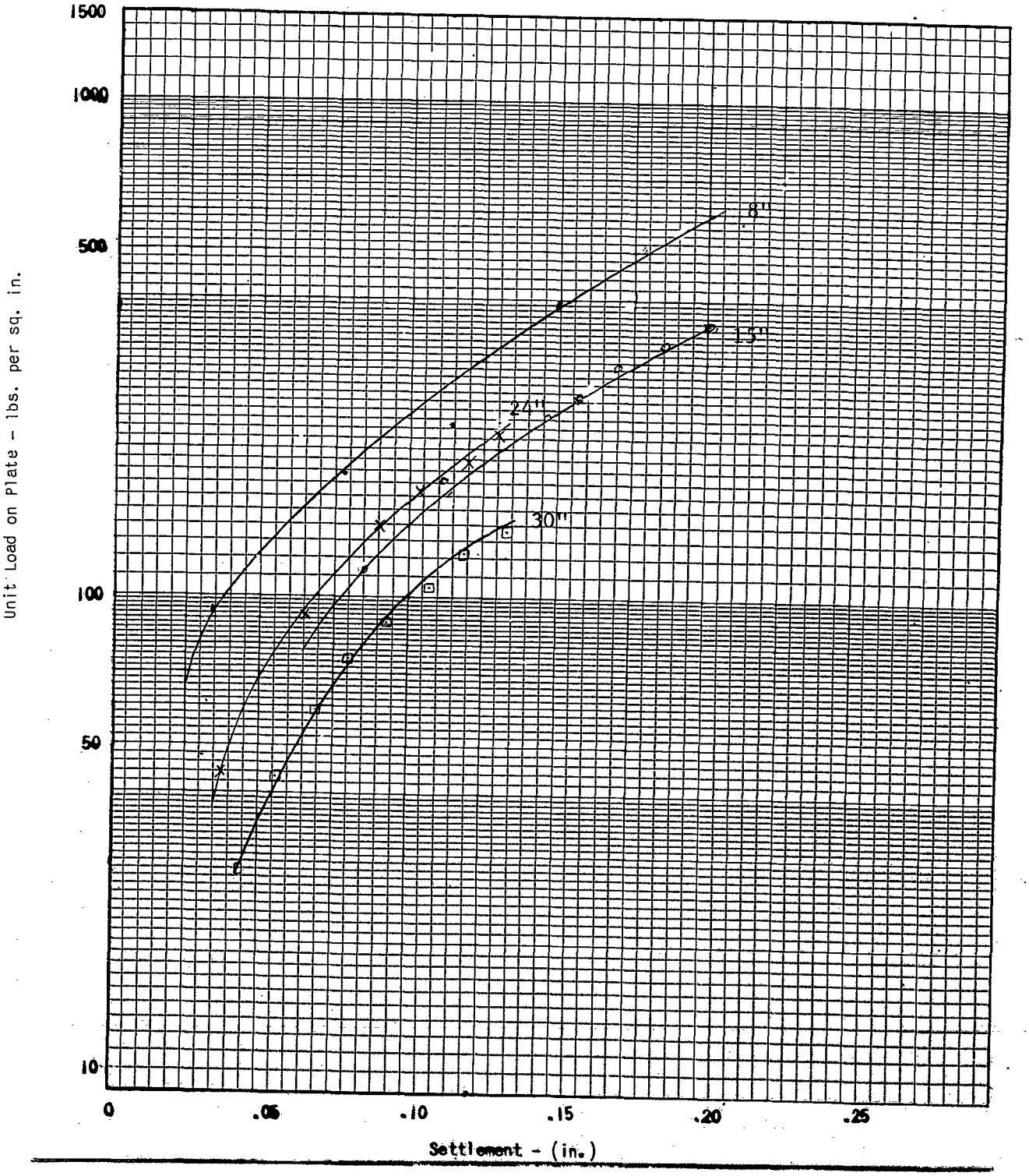


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
US MCAS Yuma, Arizona	Taxiway 6	6+00

PLATE BEARING TEST DATA

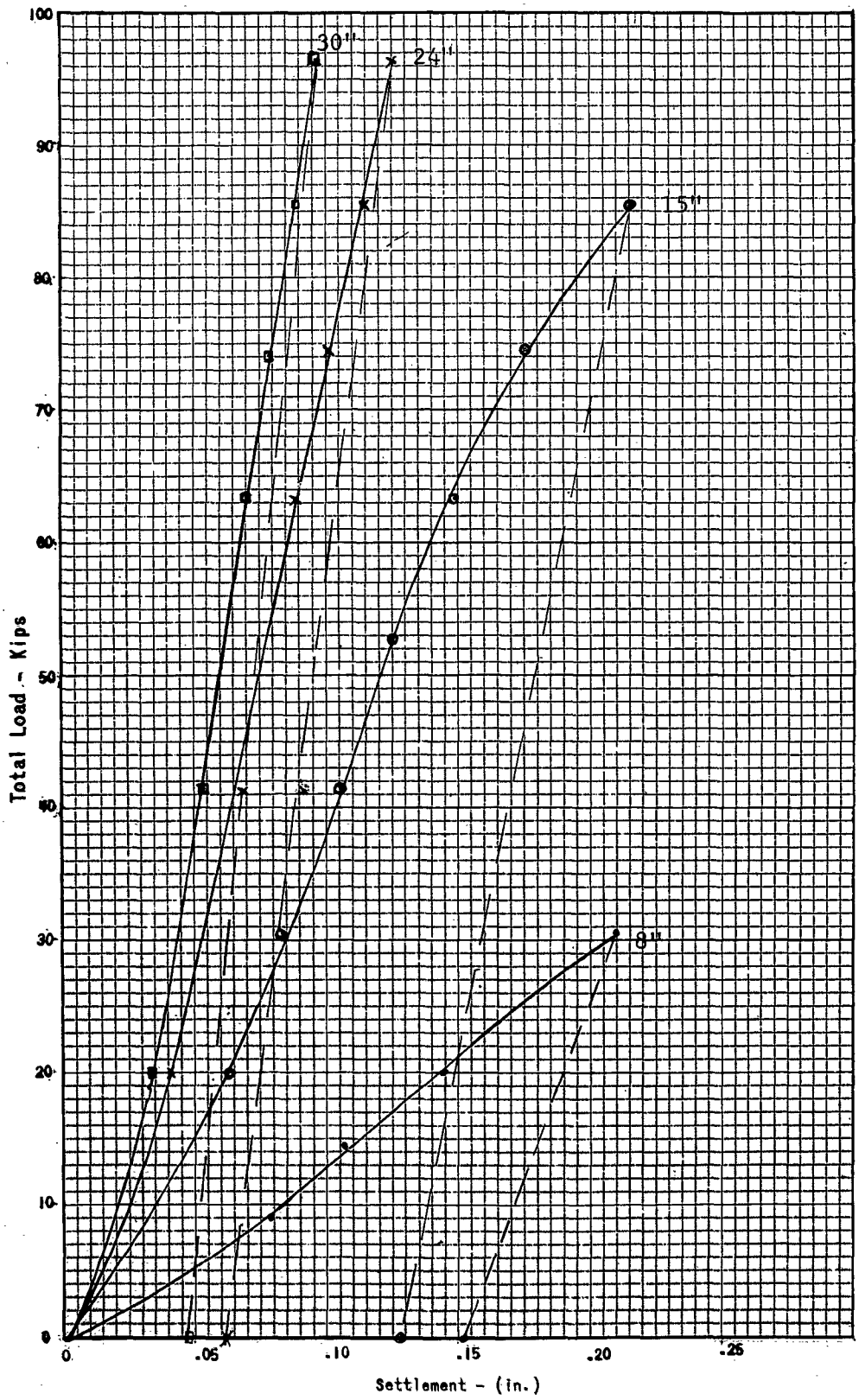
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	14+00

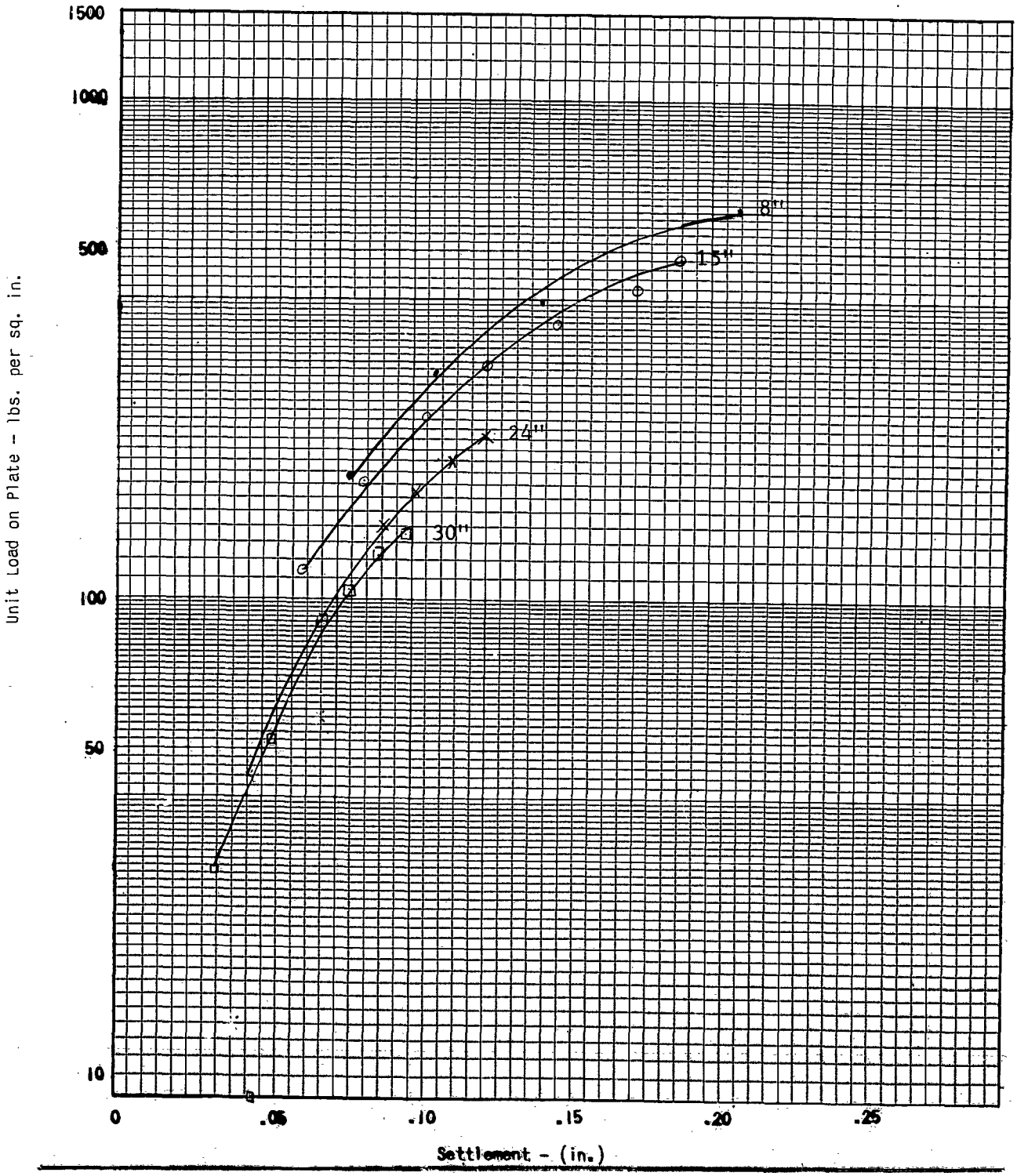


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	14+00

PLATE BEARING TEST DATA

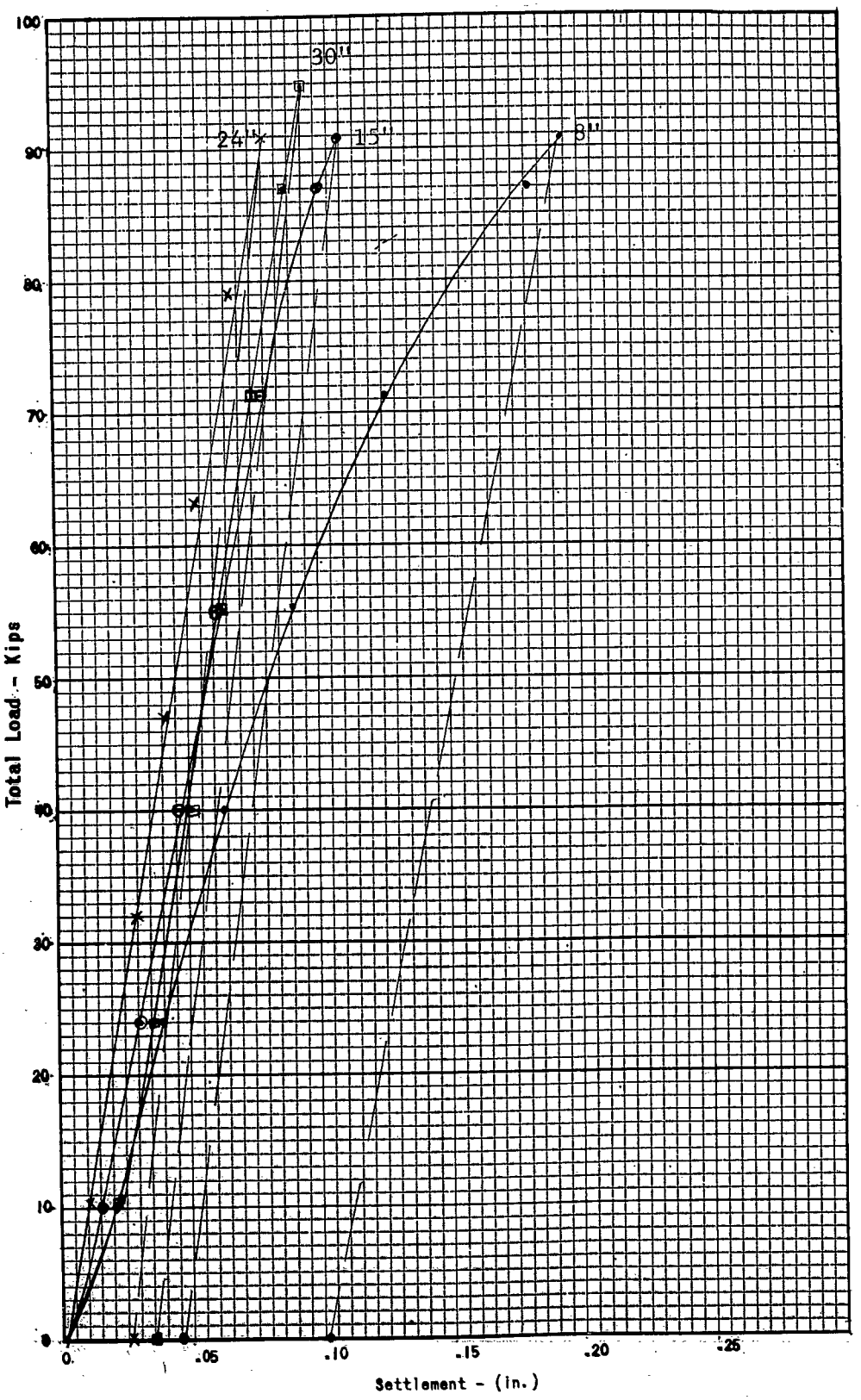
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	1+50 Offset

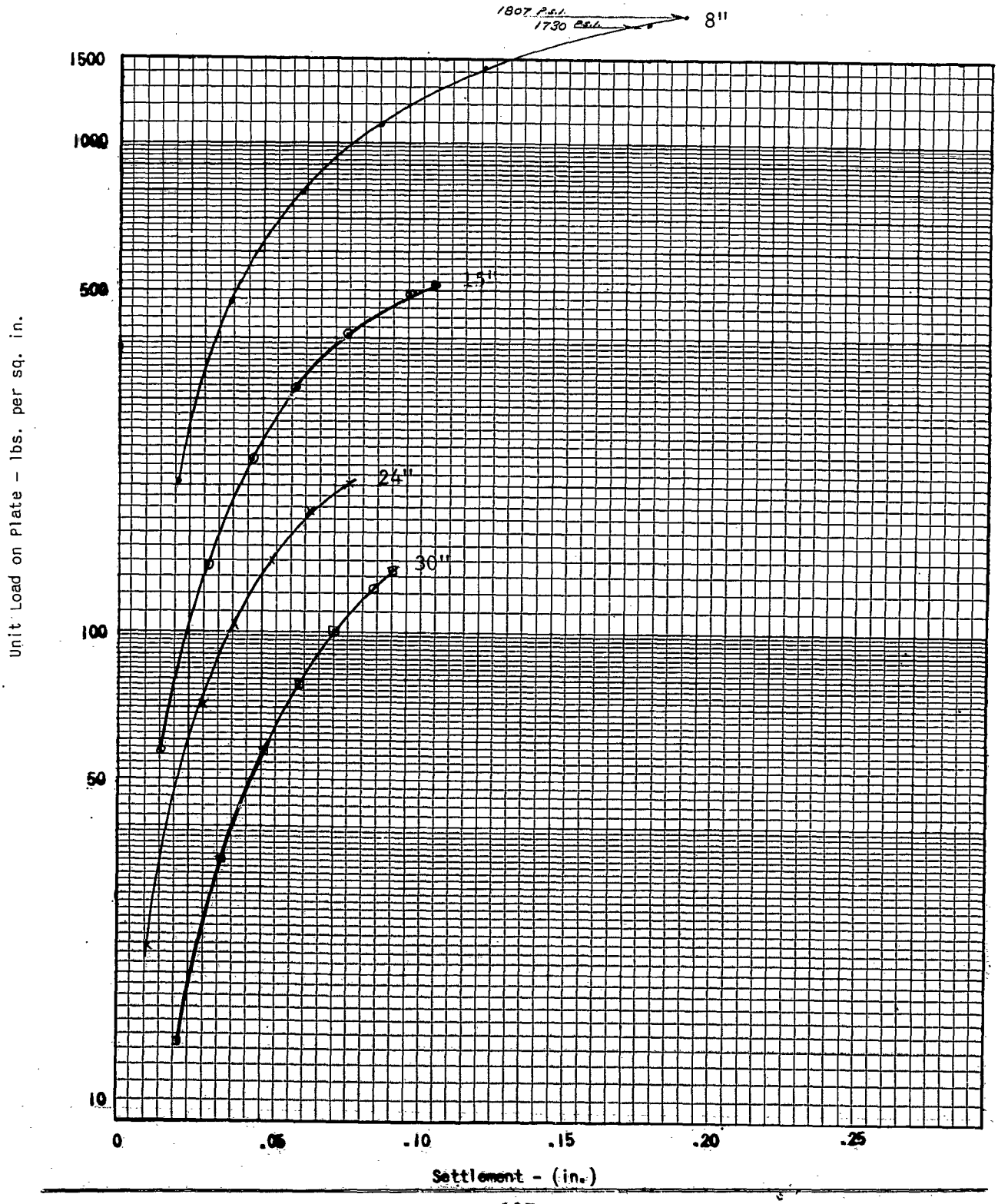


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	1+50 Offset

PLATE BEARING TEST DATA

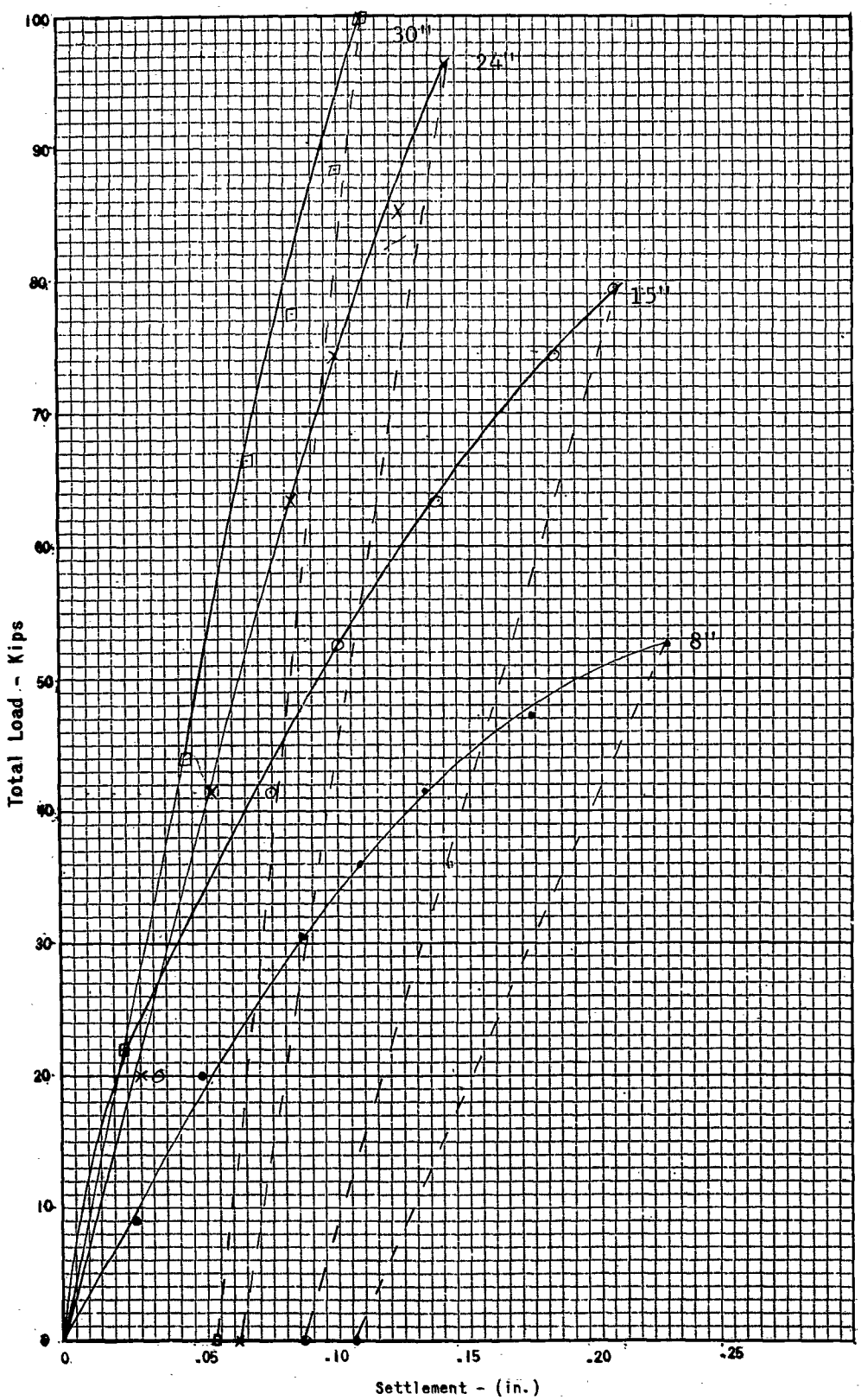
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	6+00

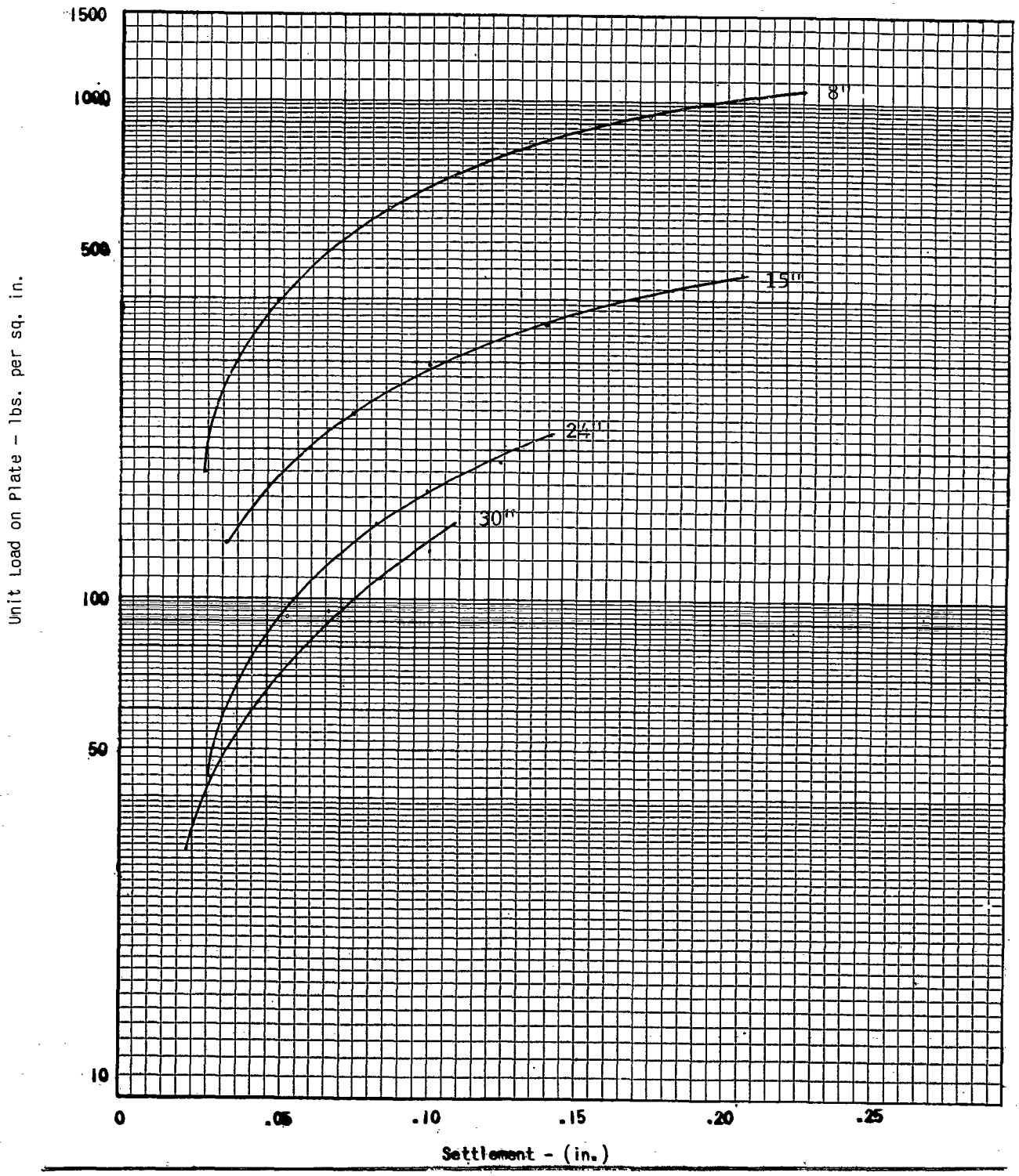


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	6+00

PLATE BEARING TEST DATA

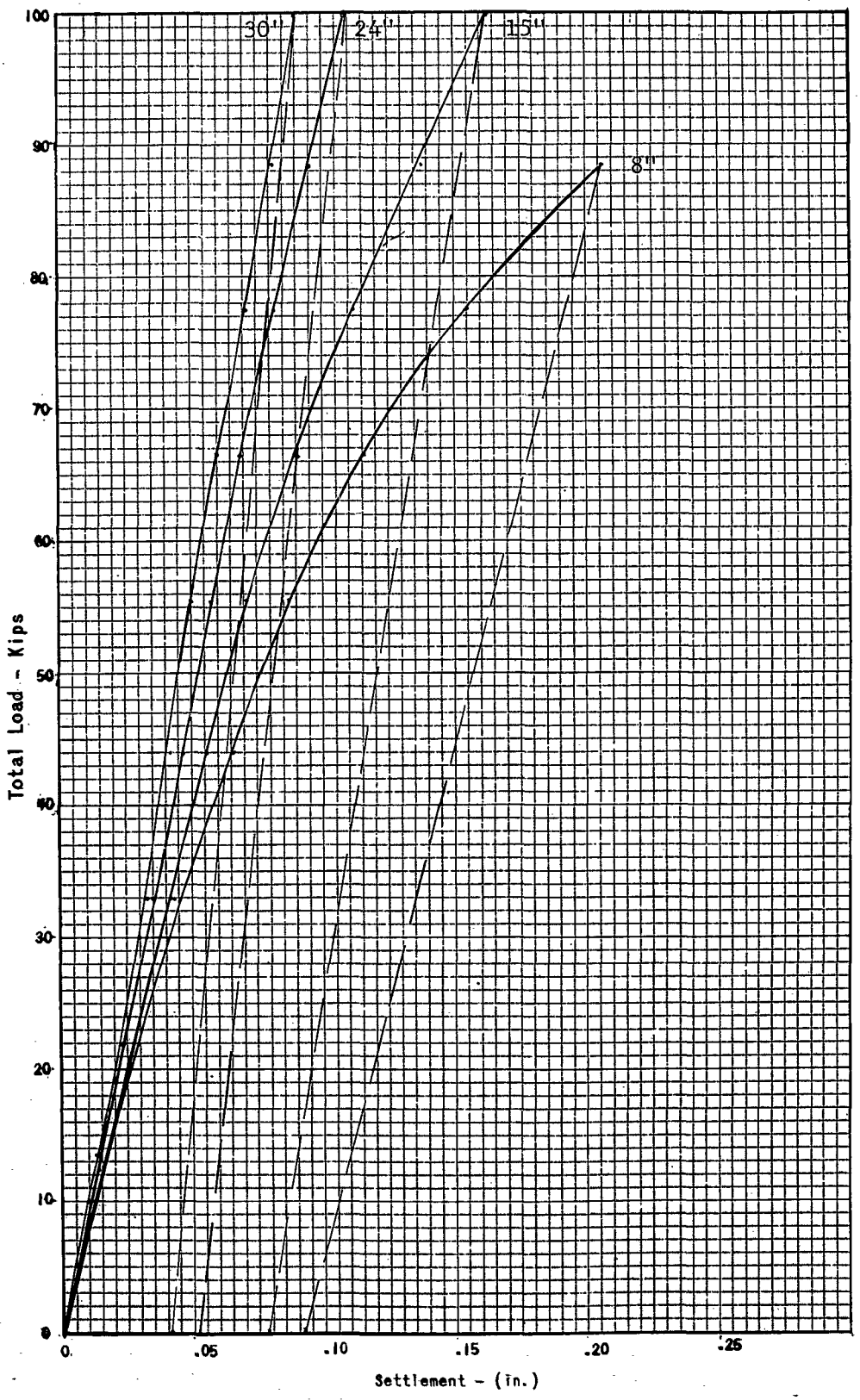
Pressure vs. Deflection



IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	16+00

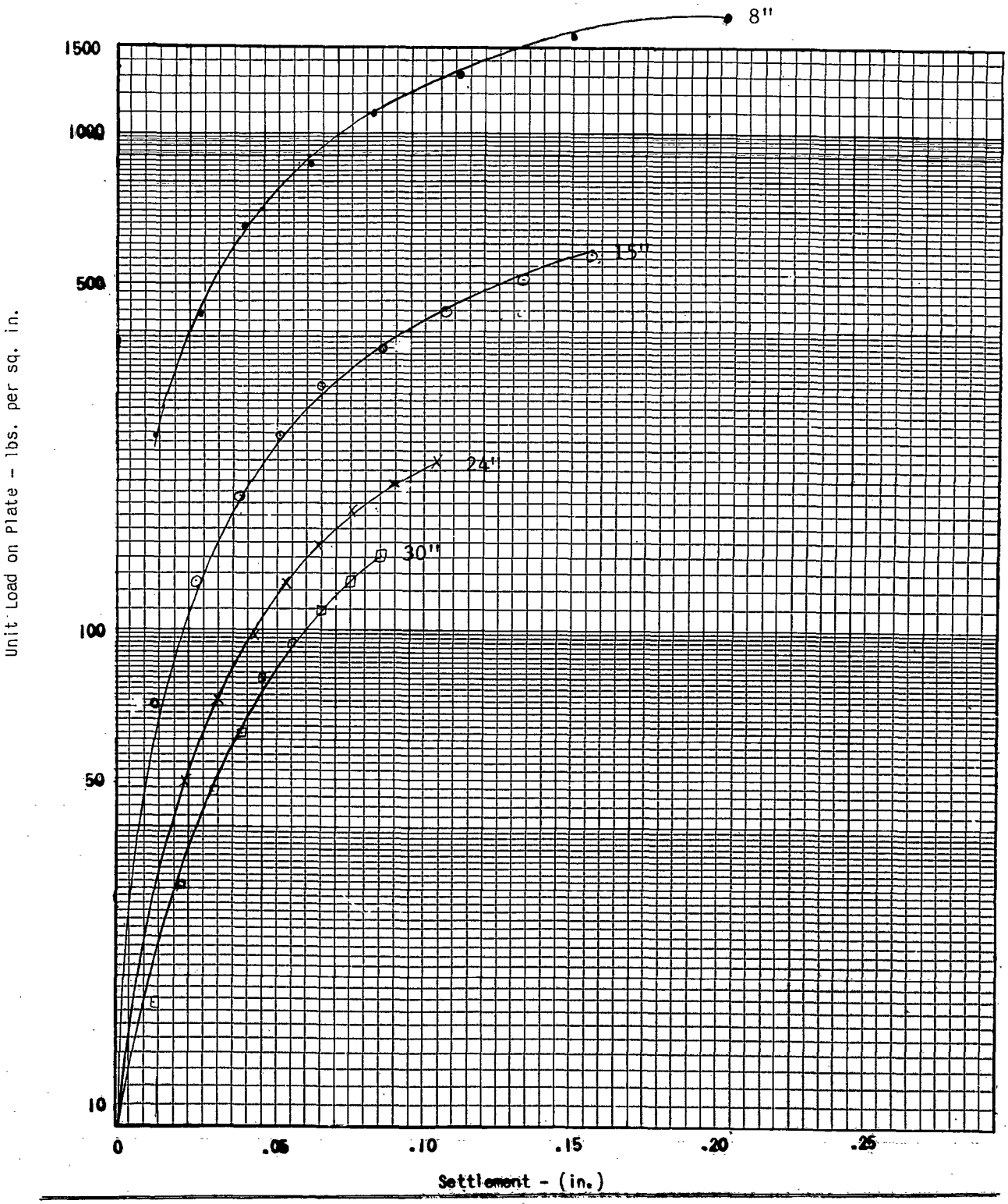


11ND NCEL 3960/19 (1-64)

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	16+00

PLATE BEARING TEST DATA

Pressure vs. Deflection



Appendix E

ALLOWABLE GROSS AIRCRAFT LOAD CURVES

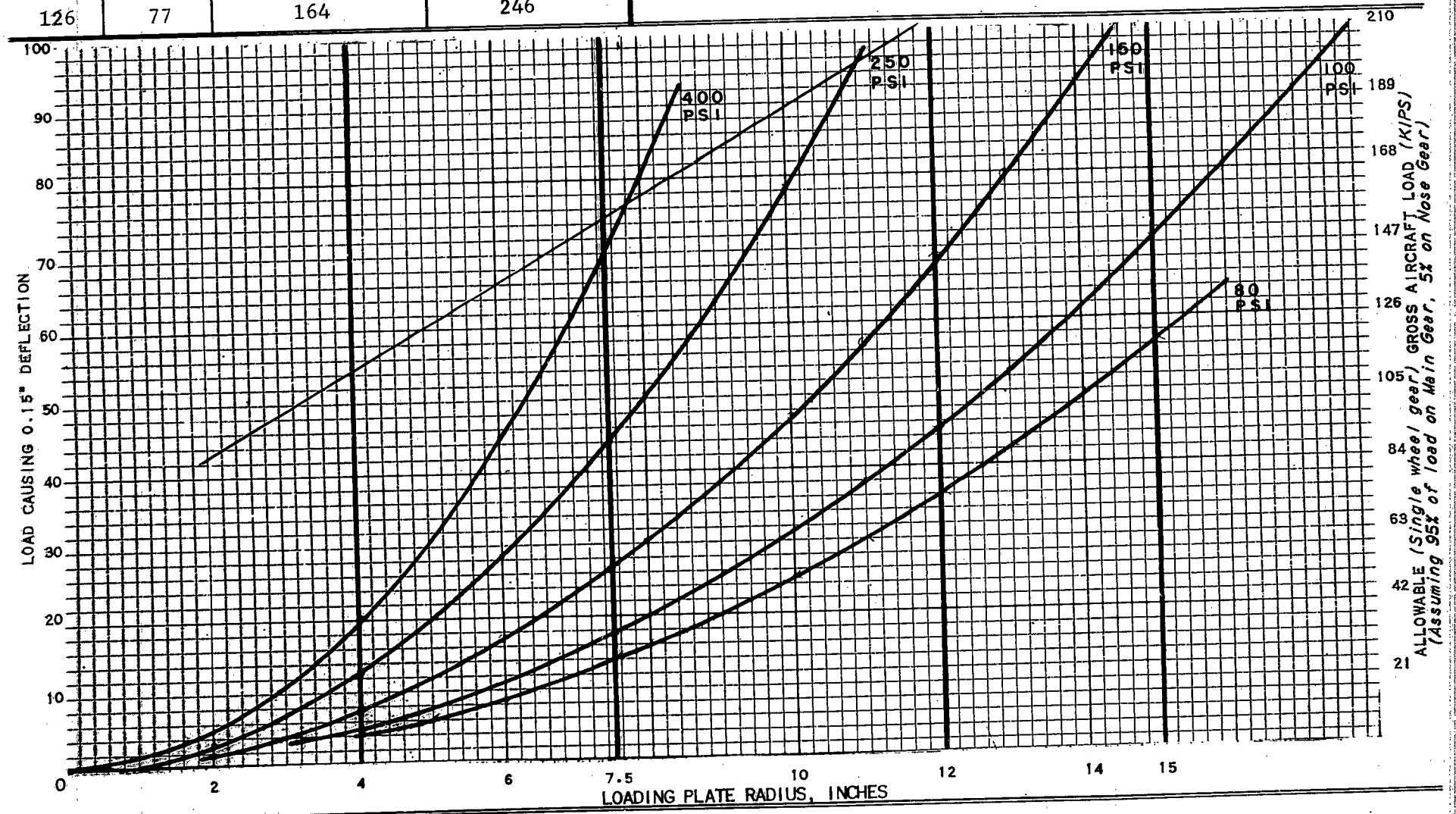
IIND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Runway 03R-21L	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
126	77	164	246

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



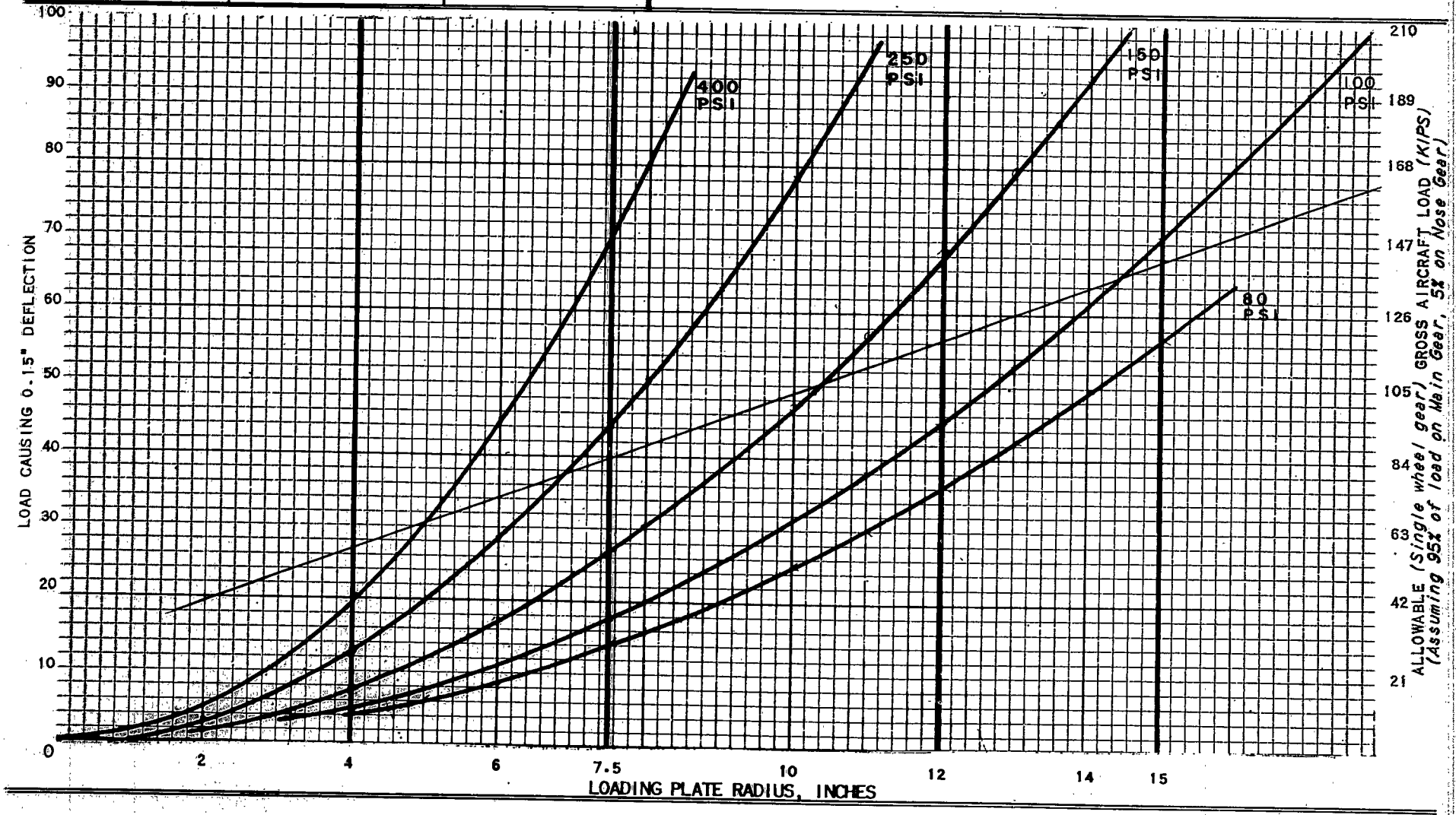
IND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Runway 8-26	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
50	30	65	98

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



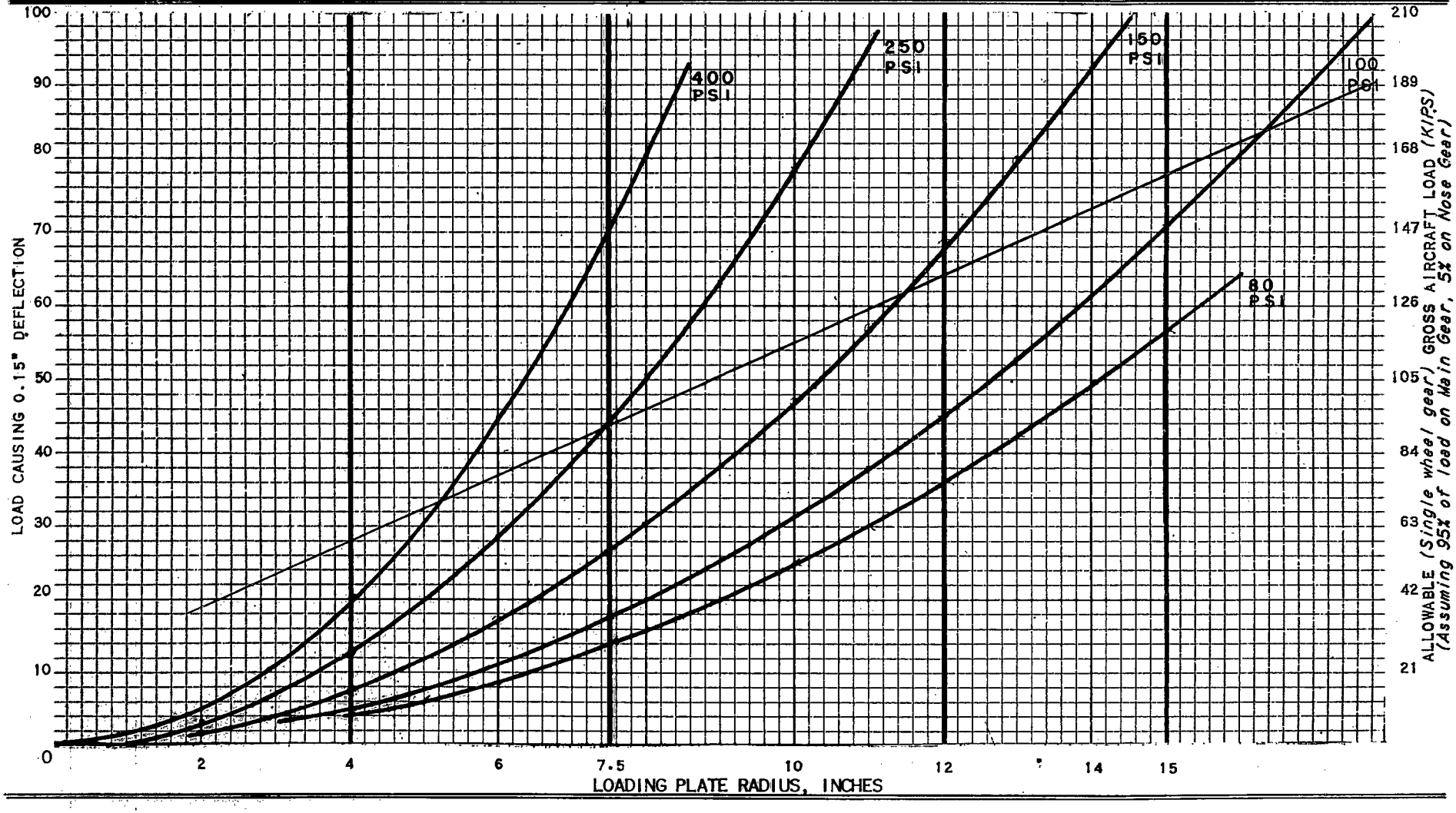
IIND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Runway 17-35	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
62	34	81	121

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



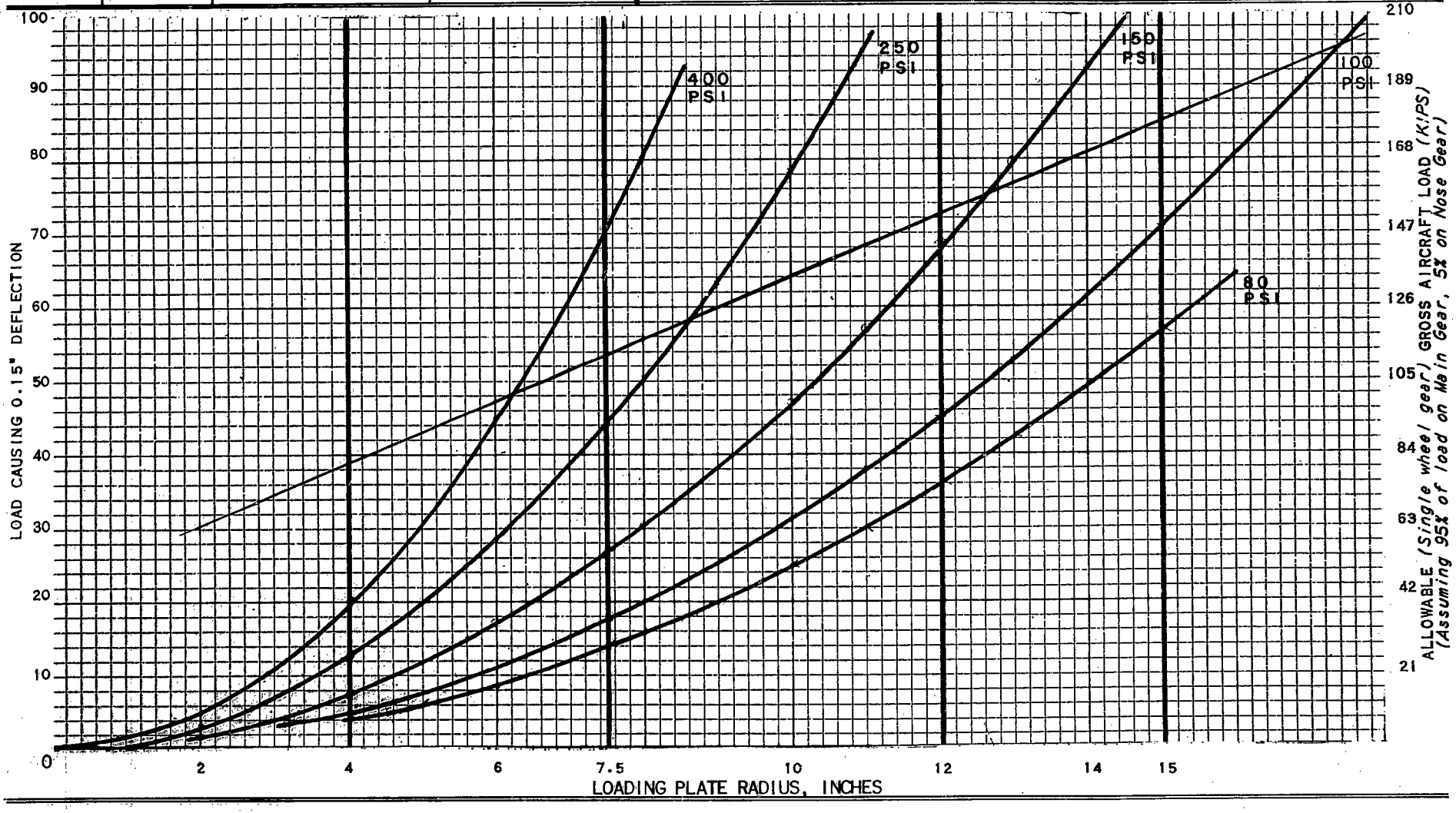
NND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 1	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
75	48	98	146

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



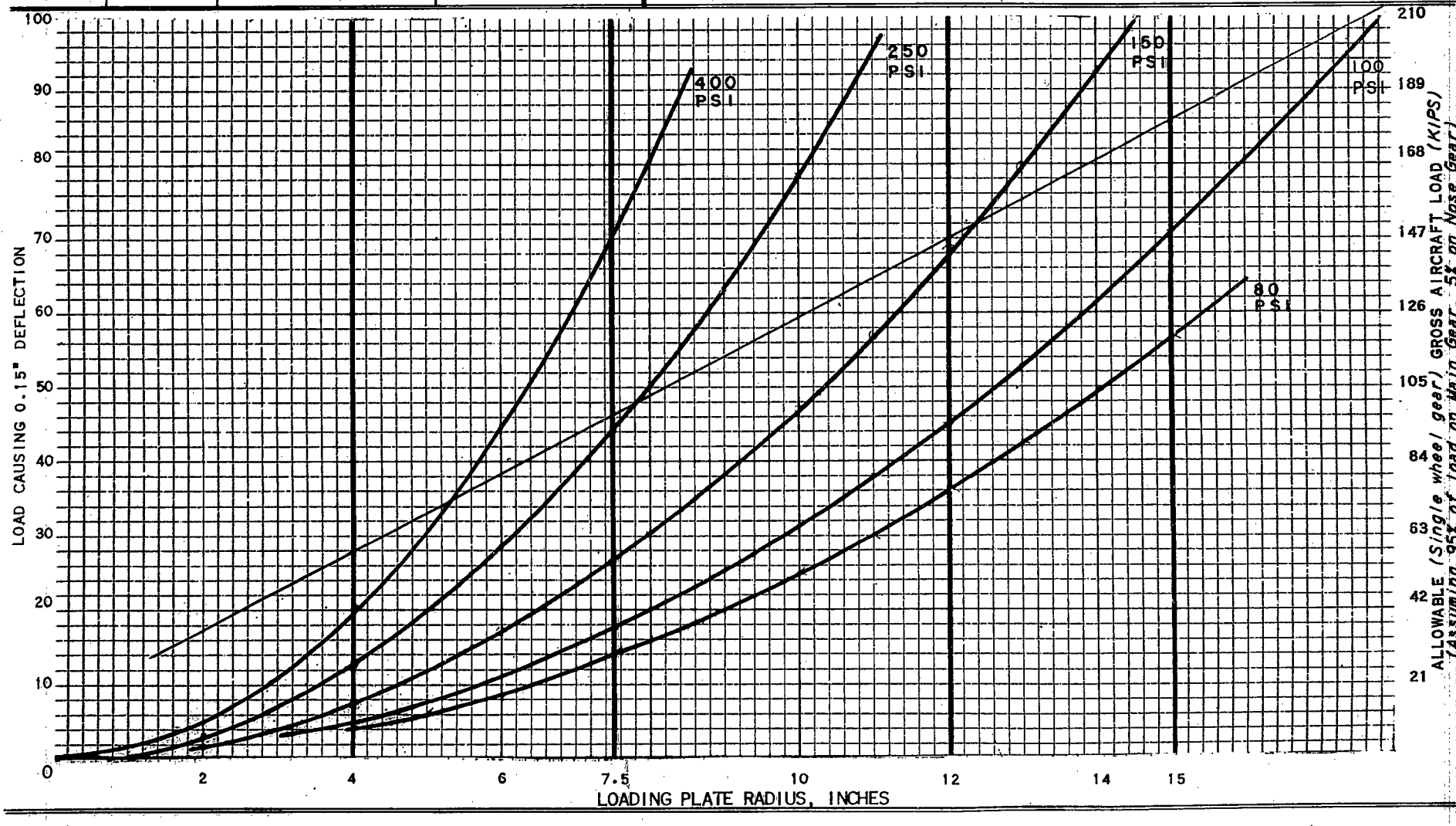
IIND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 1A	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
72	35	94	140

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



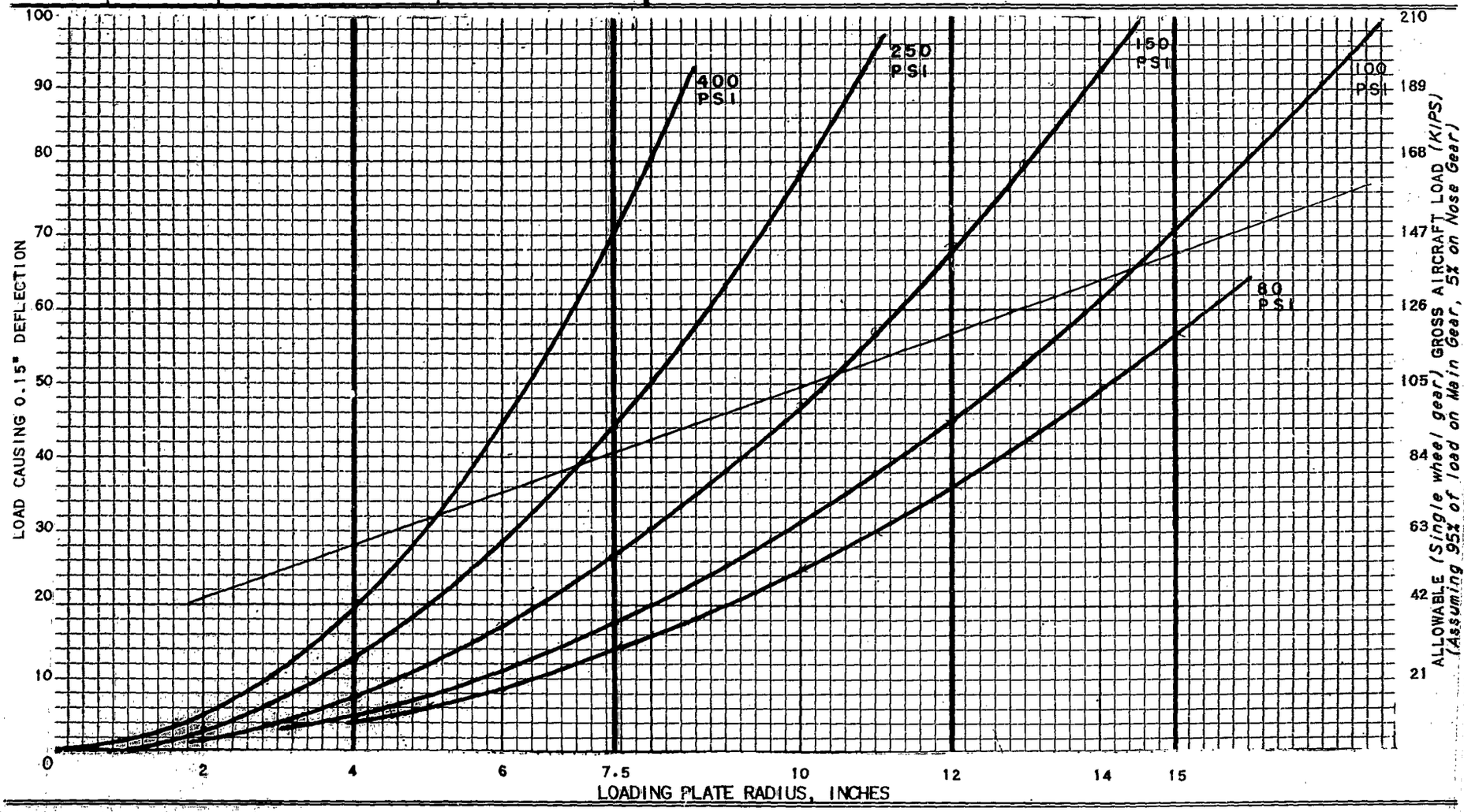
IIND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 1B	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
51	32	66	99

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



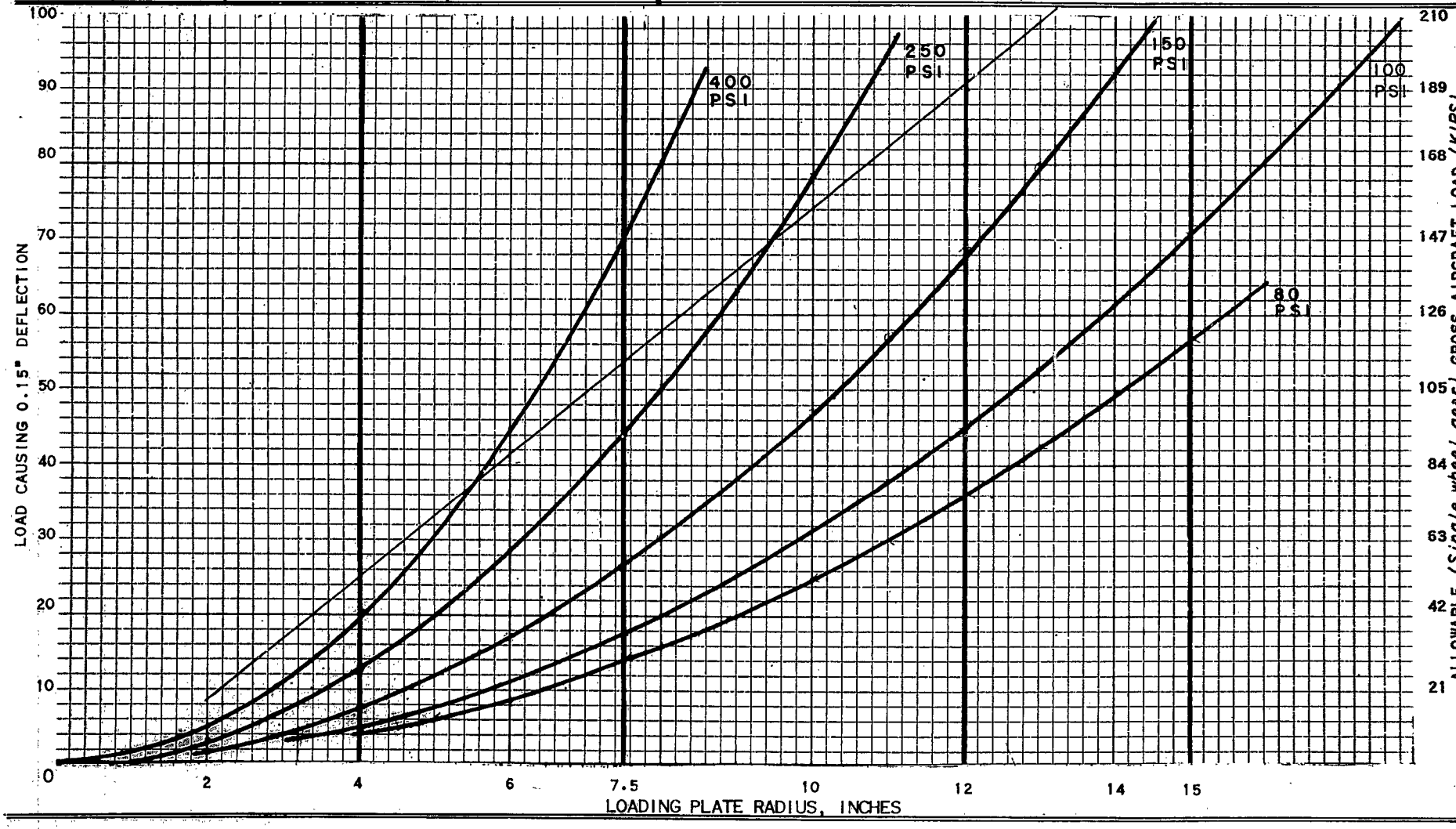
IND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 2	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
125	37	163	244

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



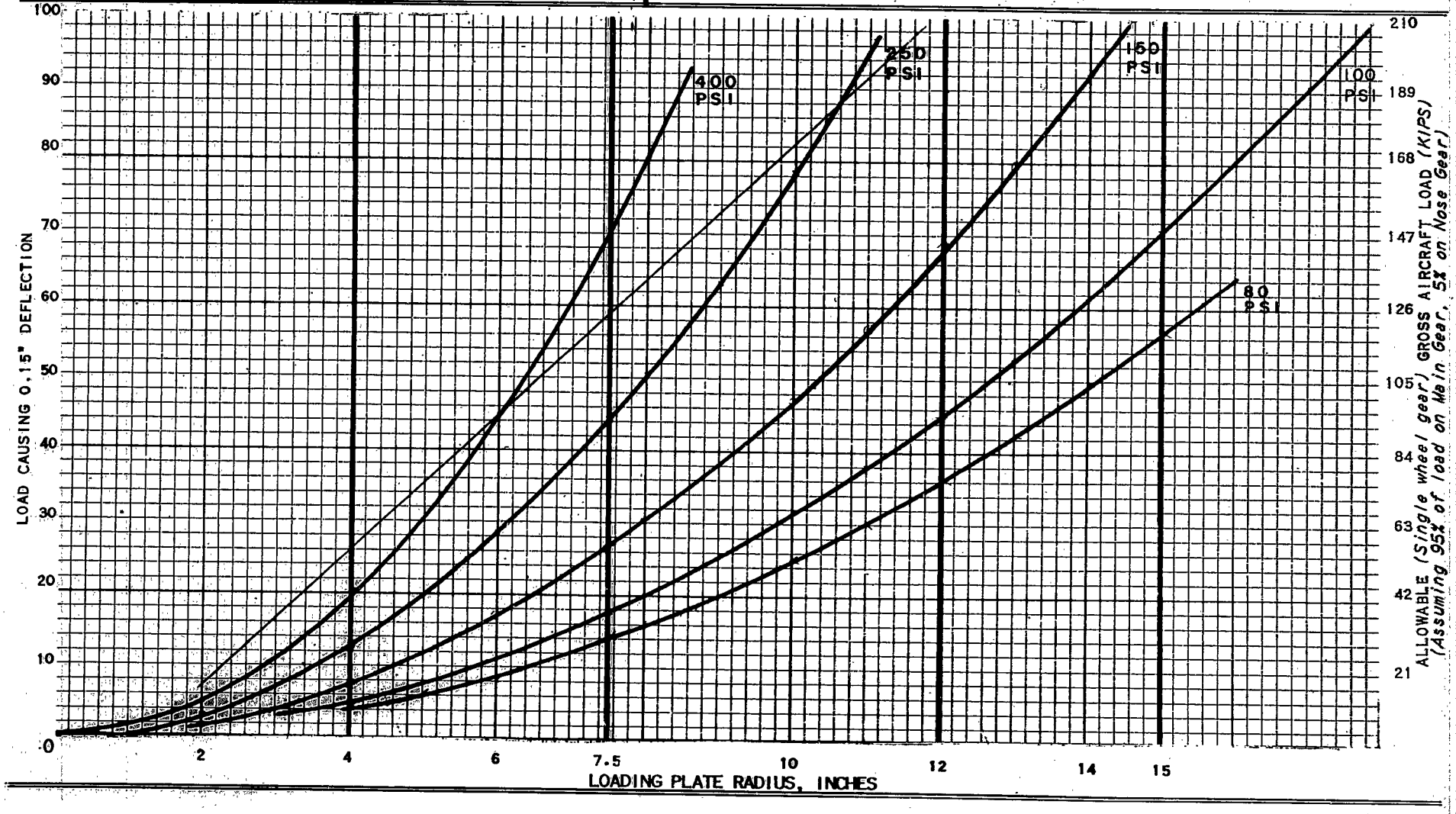
IND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 6	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
148	45	192	289

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)



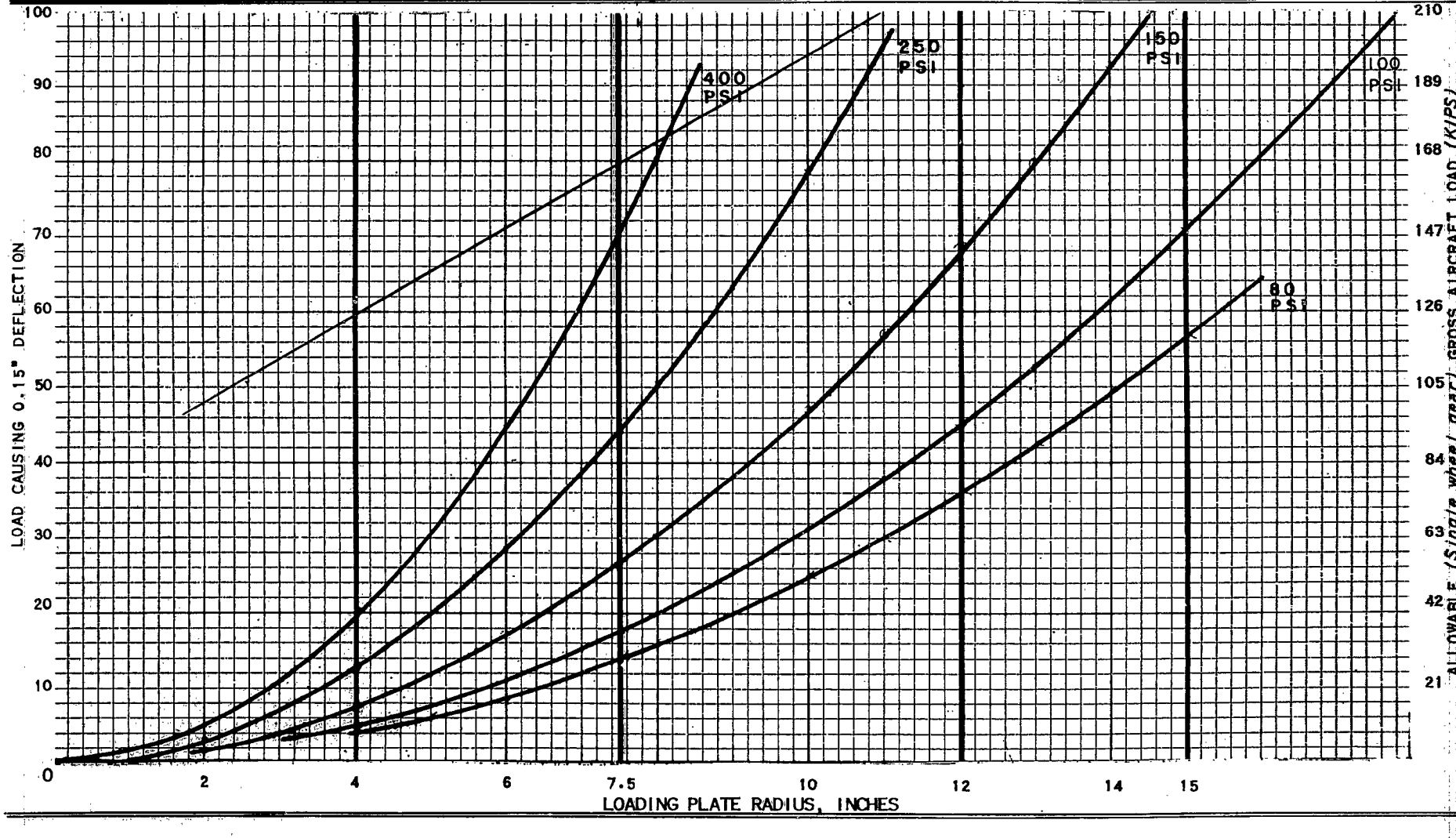
IIND-NCEL-3960/21 (REV. 6-64)

FACILITY	LOCATION	DATE
US MCAS Yuma, Arizona	Taxiway 6A	June 1964

ALLOWABLE GROSS AIRCRAFT WHEEL LOADS (KIPS)

SINGLE WHEEL GEAR		DUAL WHEEL GEAR SWG X 1.30 150 PSI	DUAL TANDEM GEAR SWG X 1.95 150 PSI
150 PSI TIRES	400 PSI TIRES		
134	83	174	261

GRAPHIC METHOD FOR DETERMINING ALLOWABLE GROSS AIRCRAFT LOADS (Single Wheel Gear)

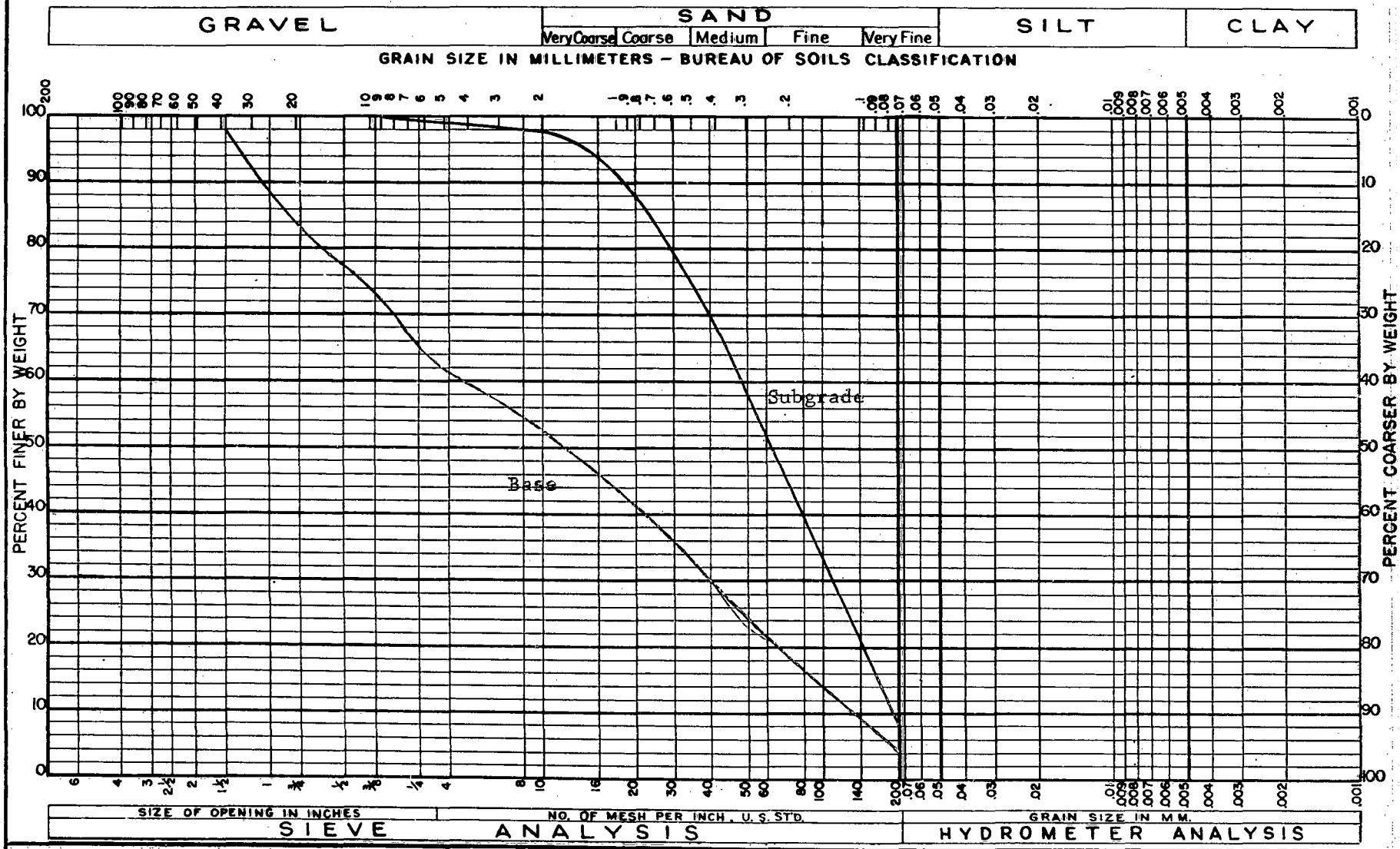


Appendix F

MECHANICAL ANALYSIS OF RECOVERED AND SUBSURFACE AGGREGATES

IND-NCEL-3960/4 (REV. 7-63)

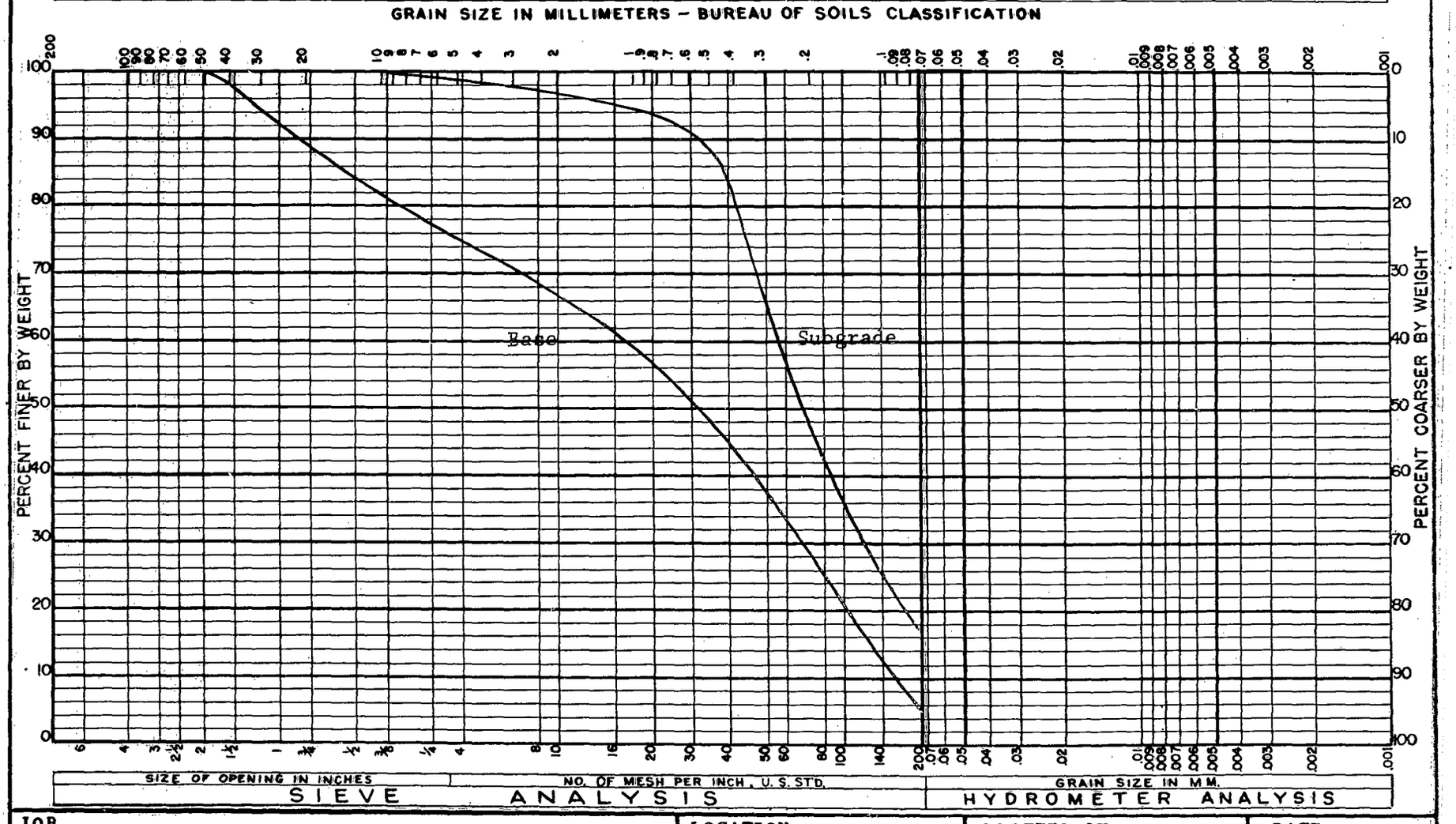
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1 - Sta 12+100	Base course and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

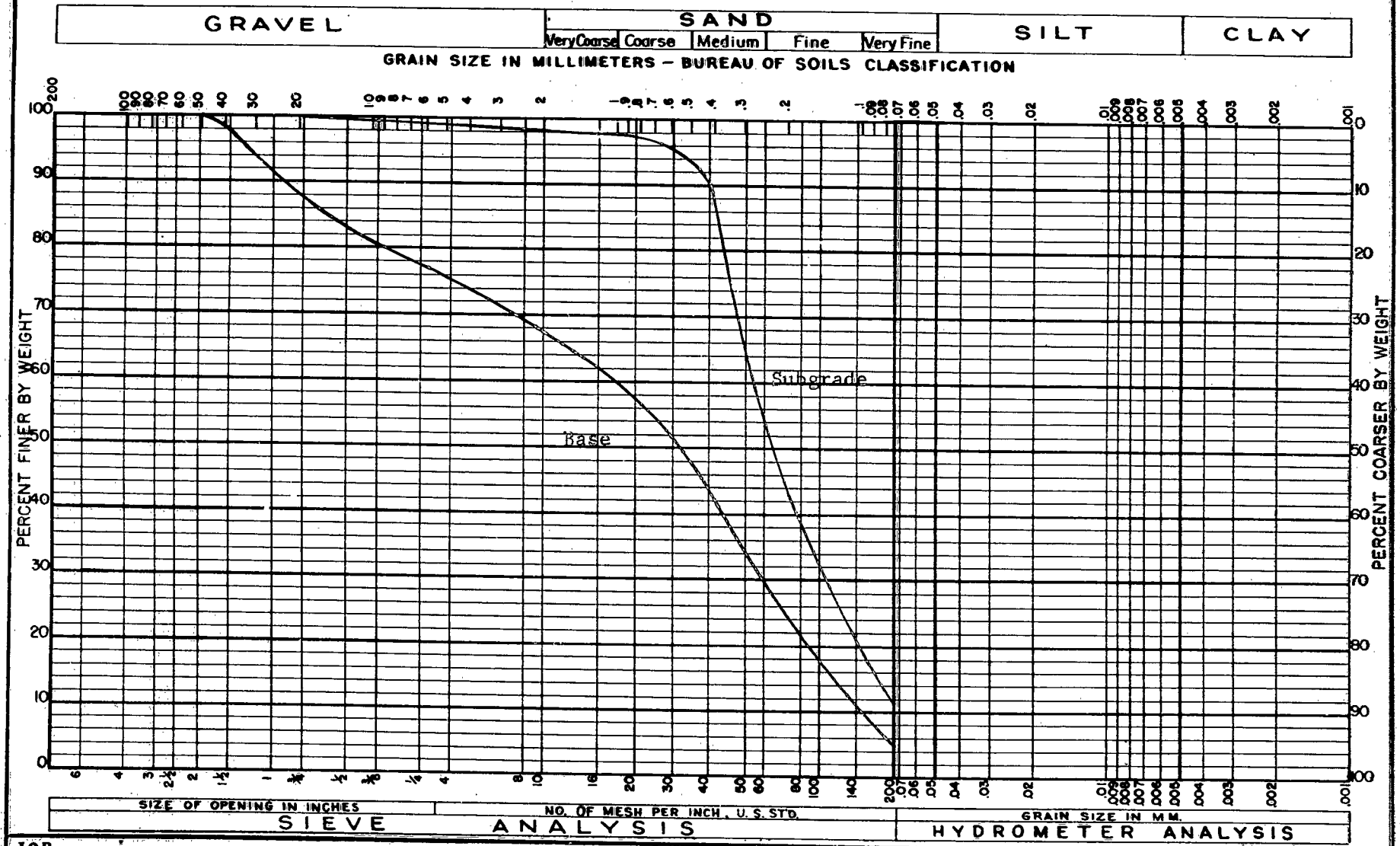
MECHANICAL ANALYSIS



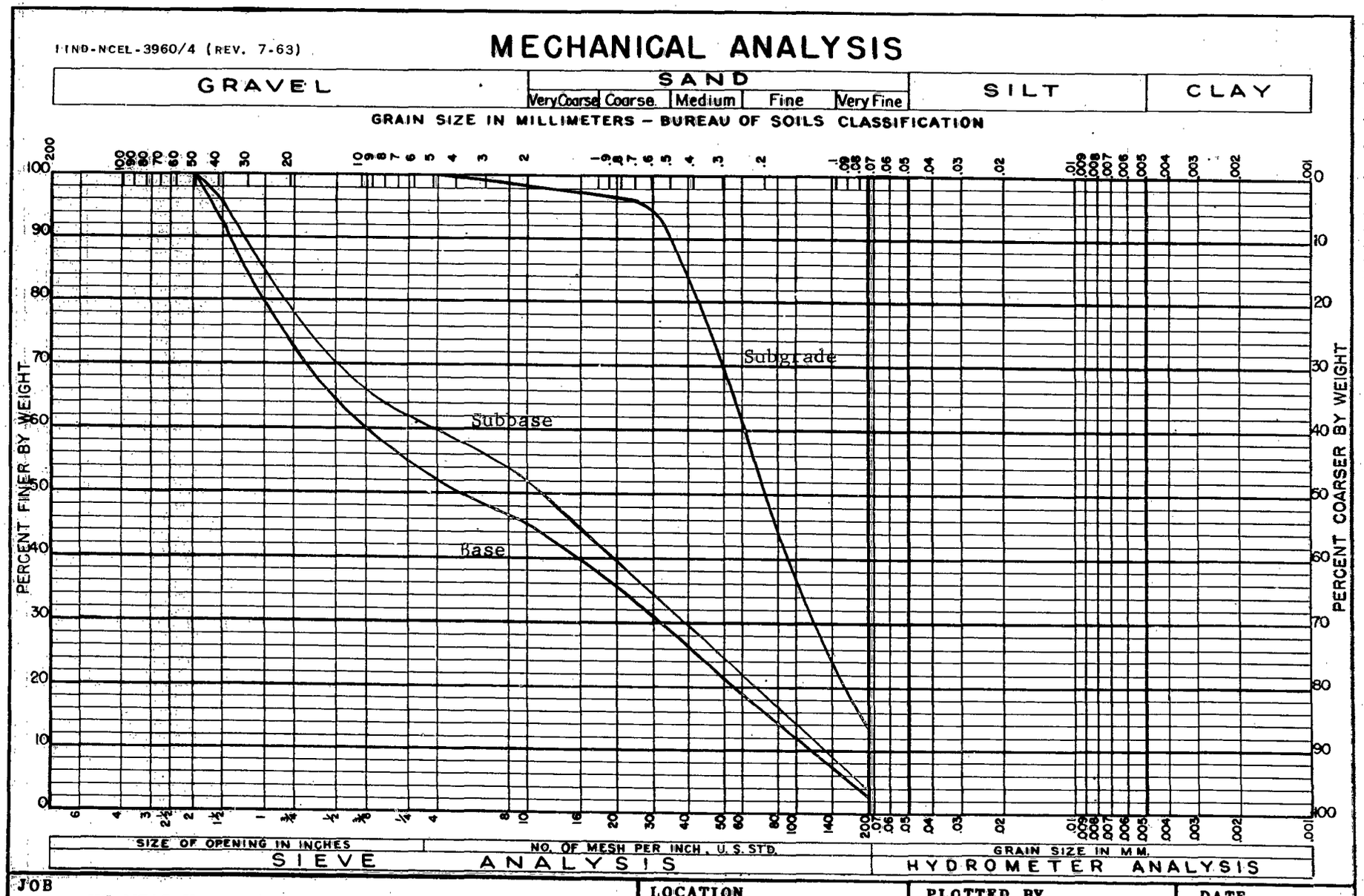
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1 - Sta 22+00	Subgrade and Base	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

MECHANICAL ANALYSIS



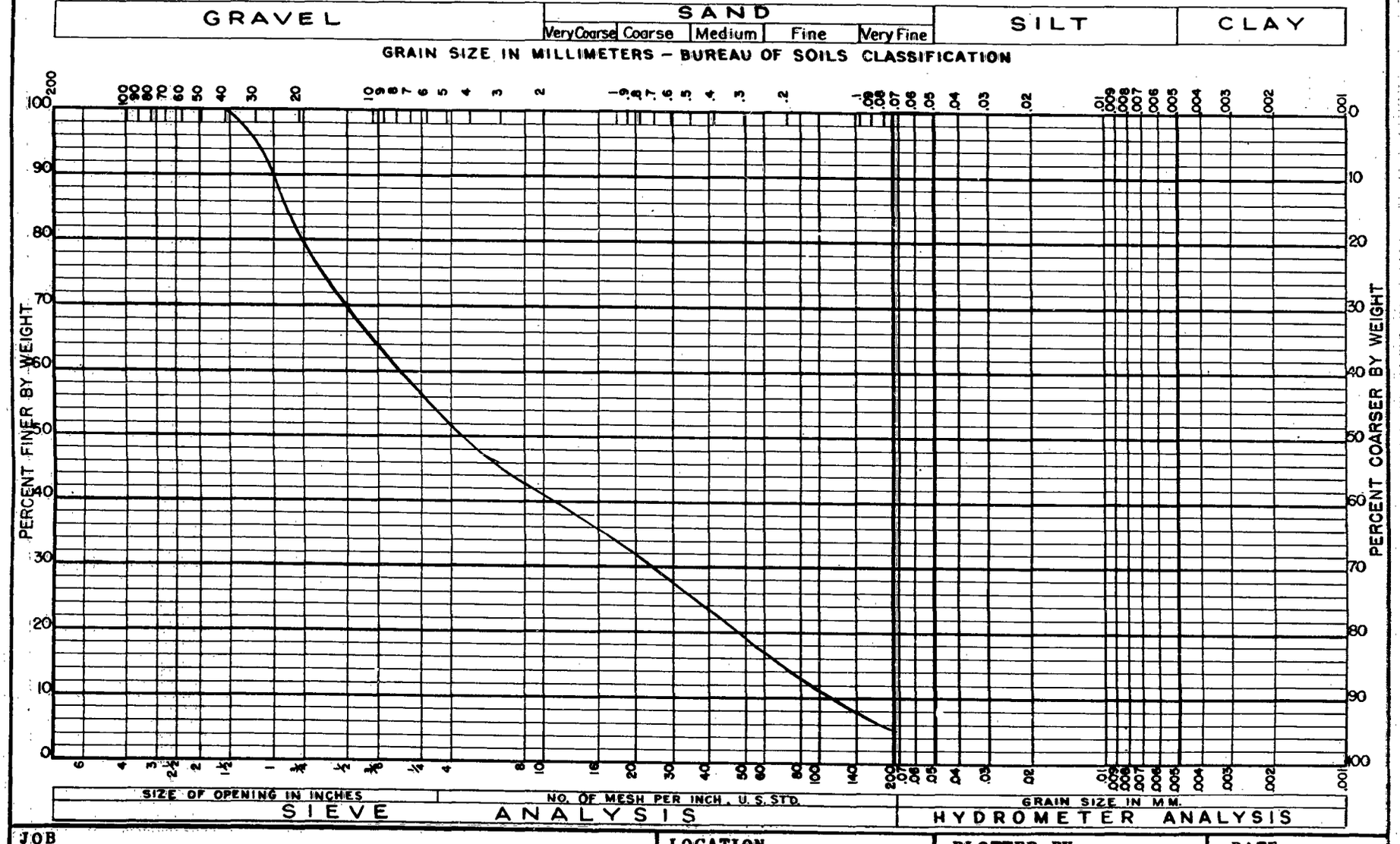
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1 - Sta 32+00	Subgrade and Base	KJD and RET	June 1964



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1 - Sta 41+00	Base, subbase and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

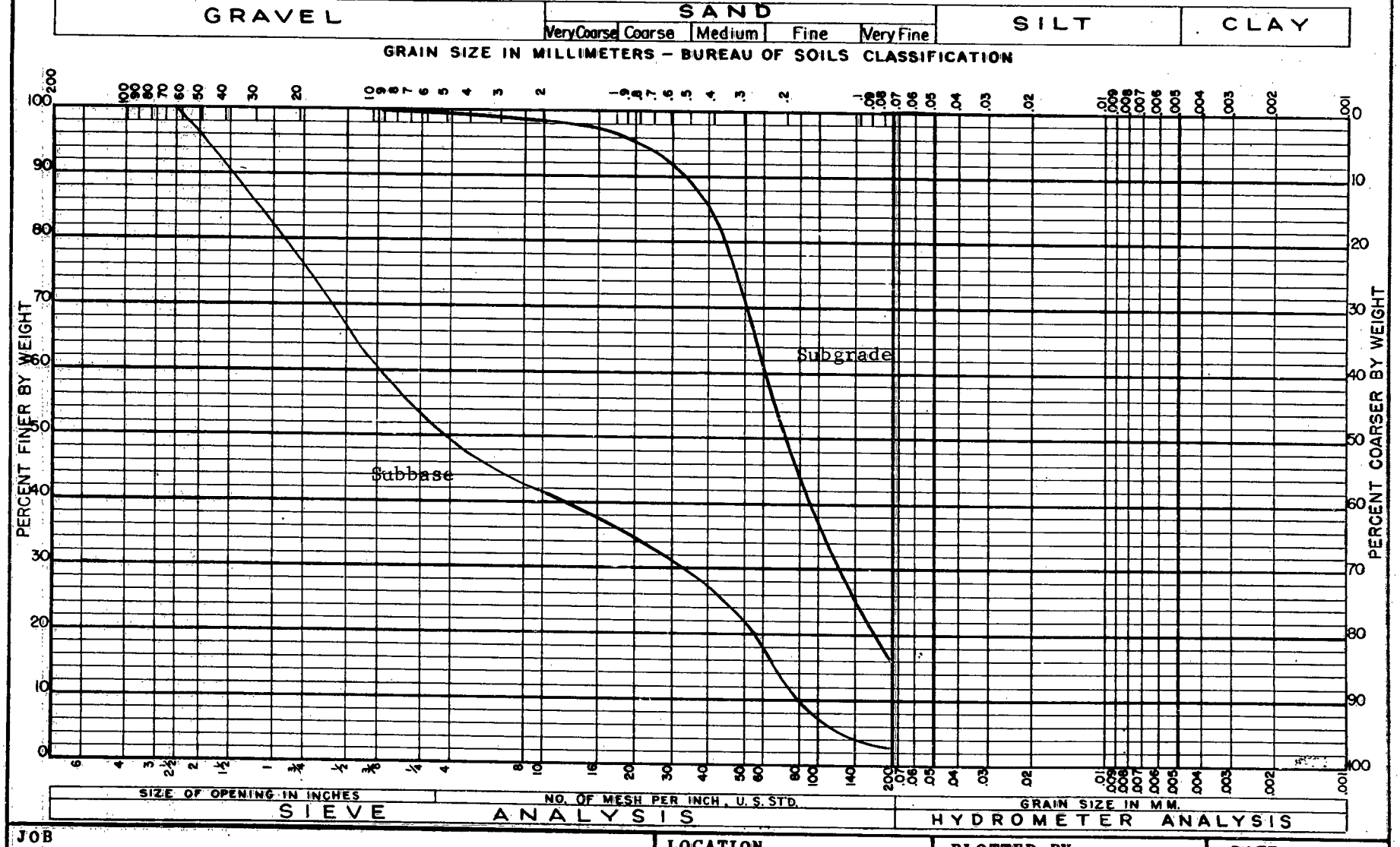
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1A - Sta 5+00	Top of base course 3 in. below top of A.C.	KJD	June 1964

FIND-NCEL-3960/4 (REV. 7-63)

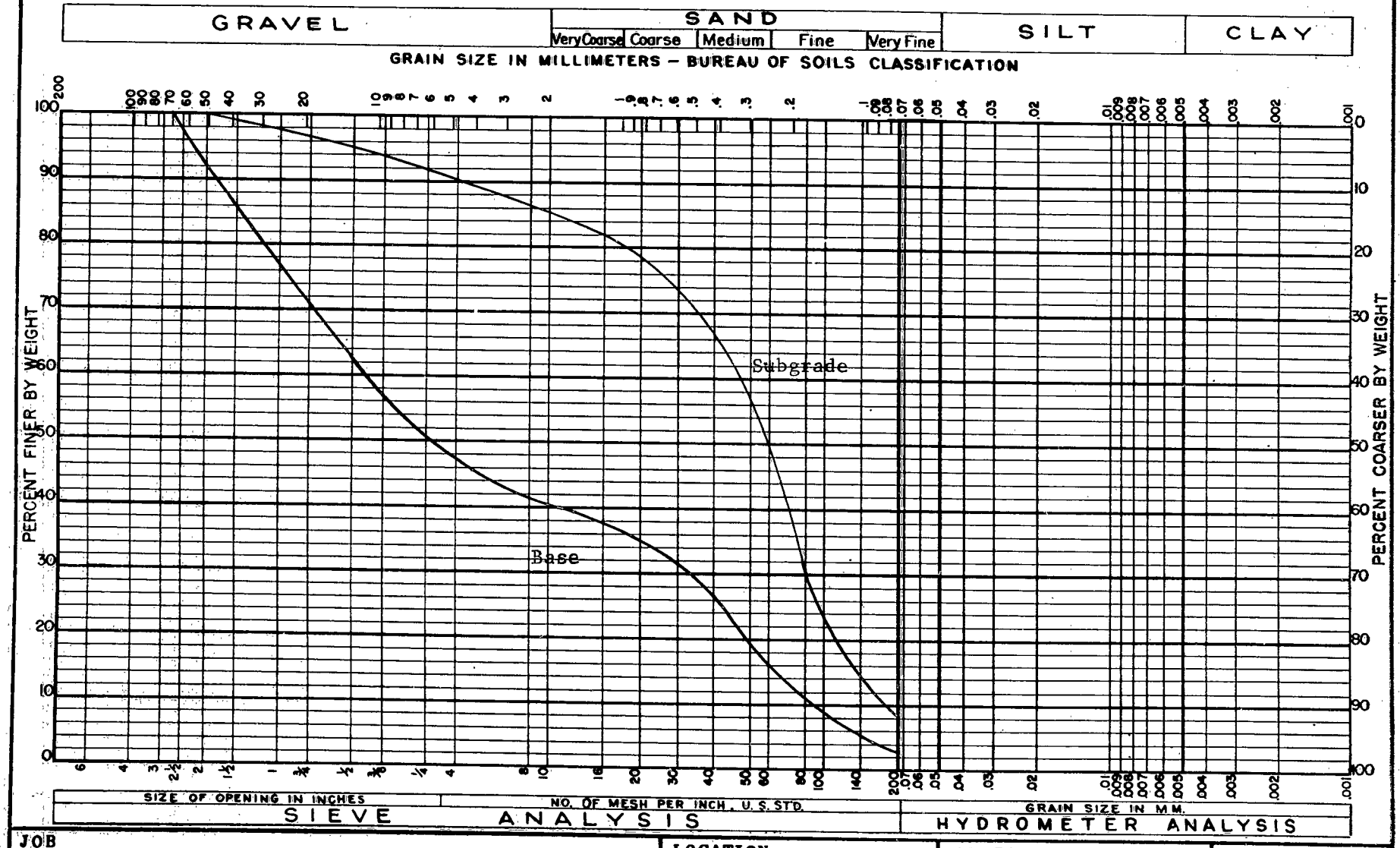
MECHANICAL ANALYSIS



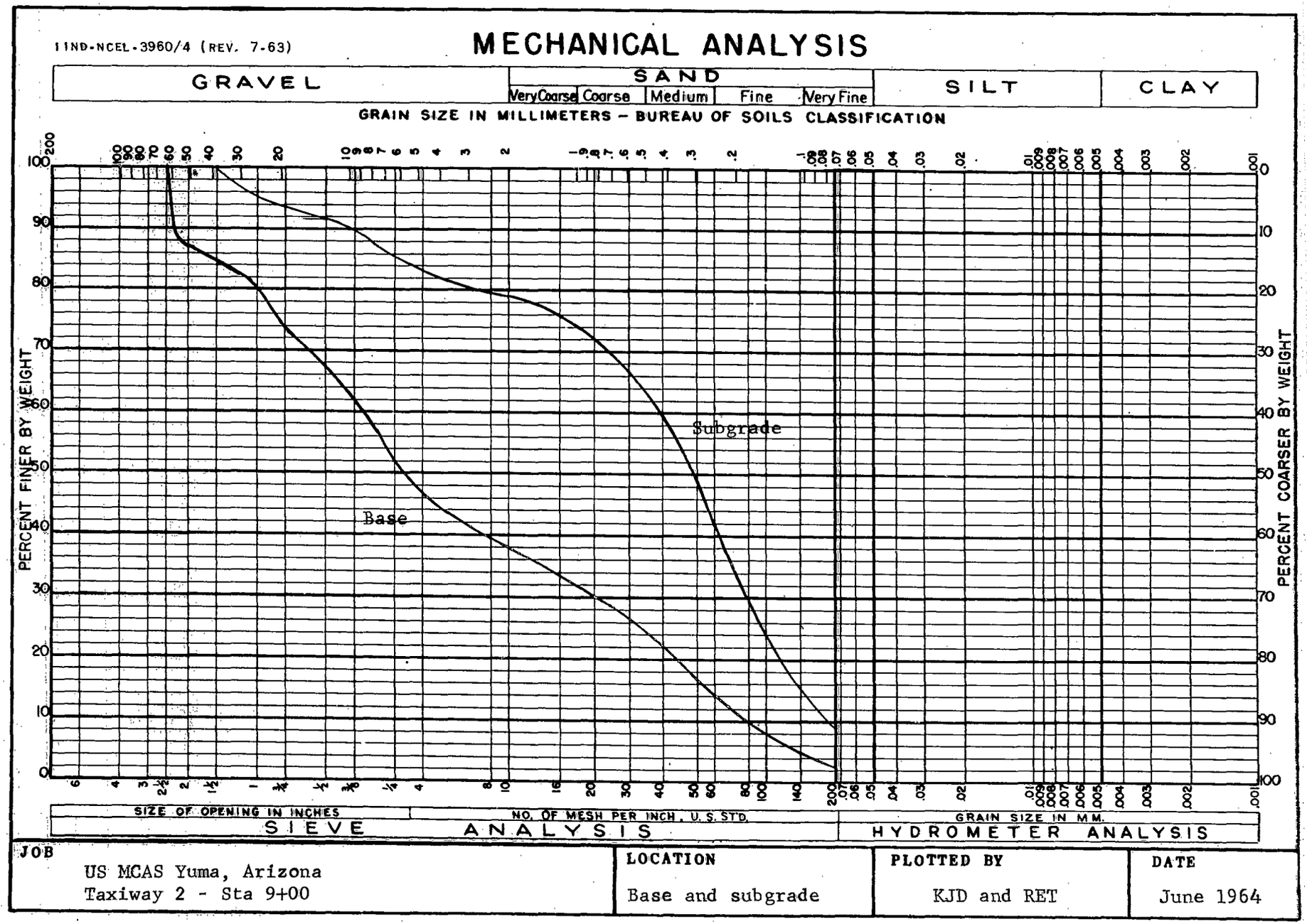
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 1A - Sta 5+00	Subbase and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

MECHANICAL ANALYSIS



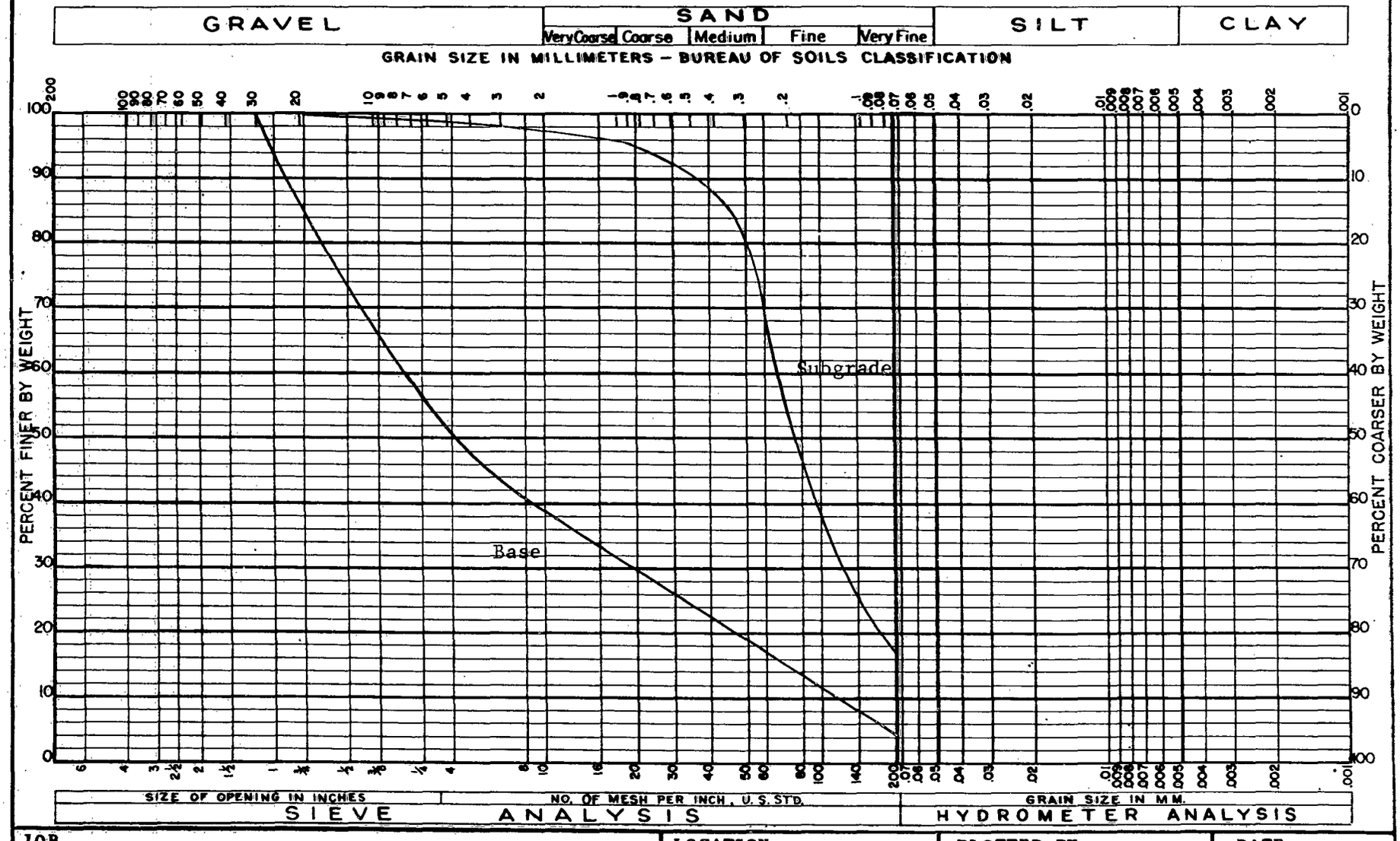
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 2 - Sta 2+00	Base and subgrade	KJD and RET	June 1964



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 2 - Sta 9+00	Base and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

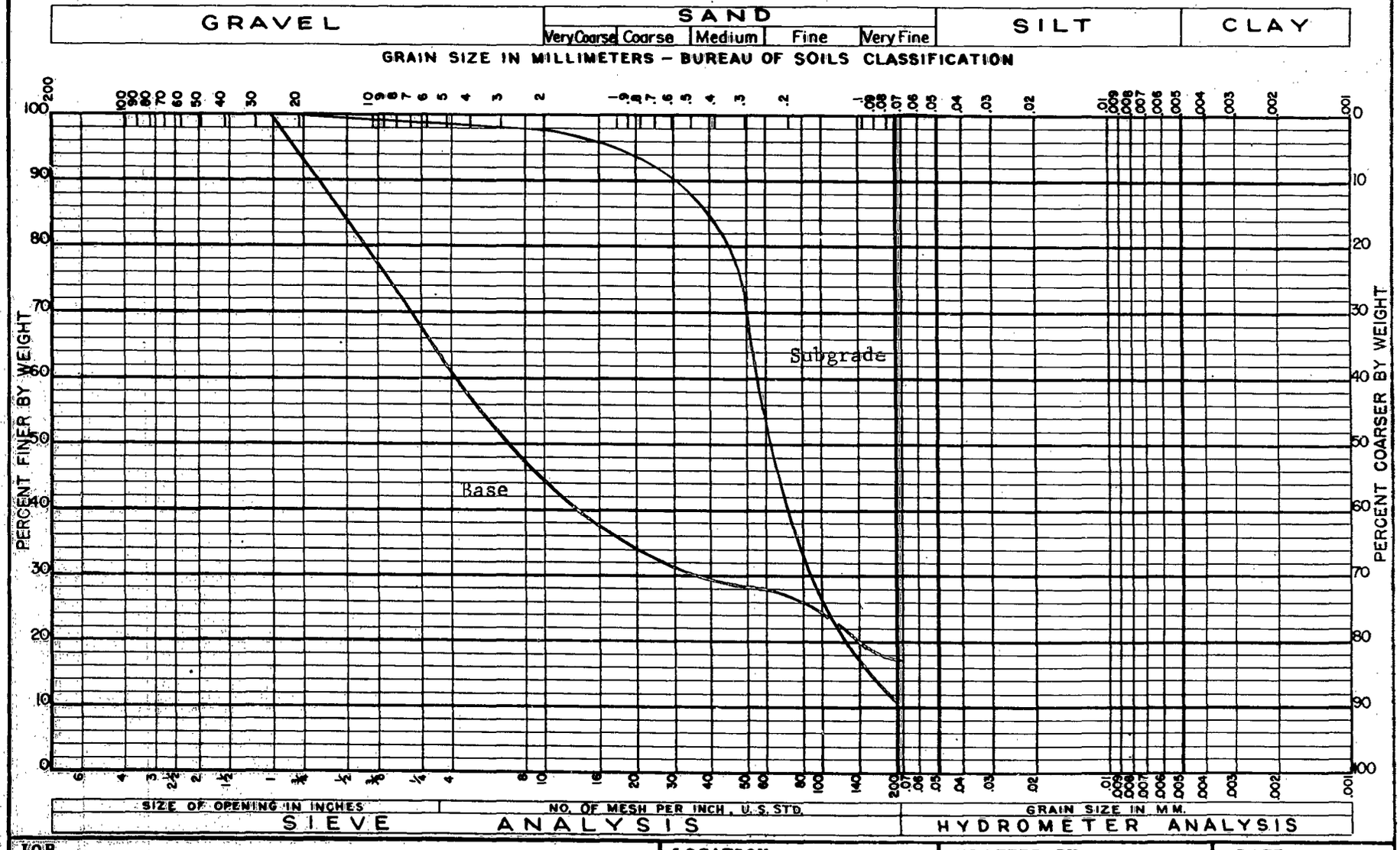
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6 - Sta 1+50 Offset	Base and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

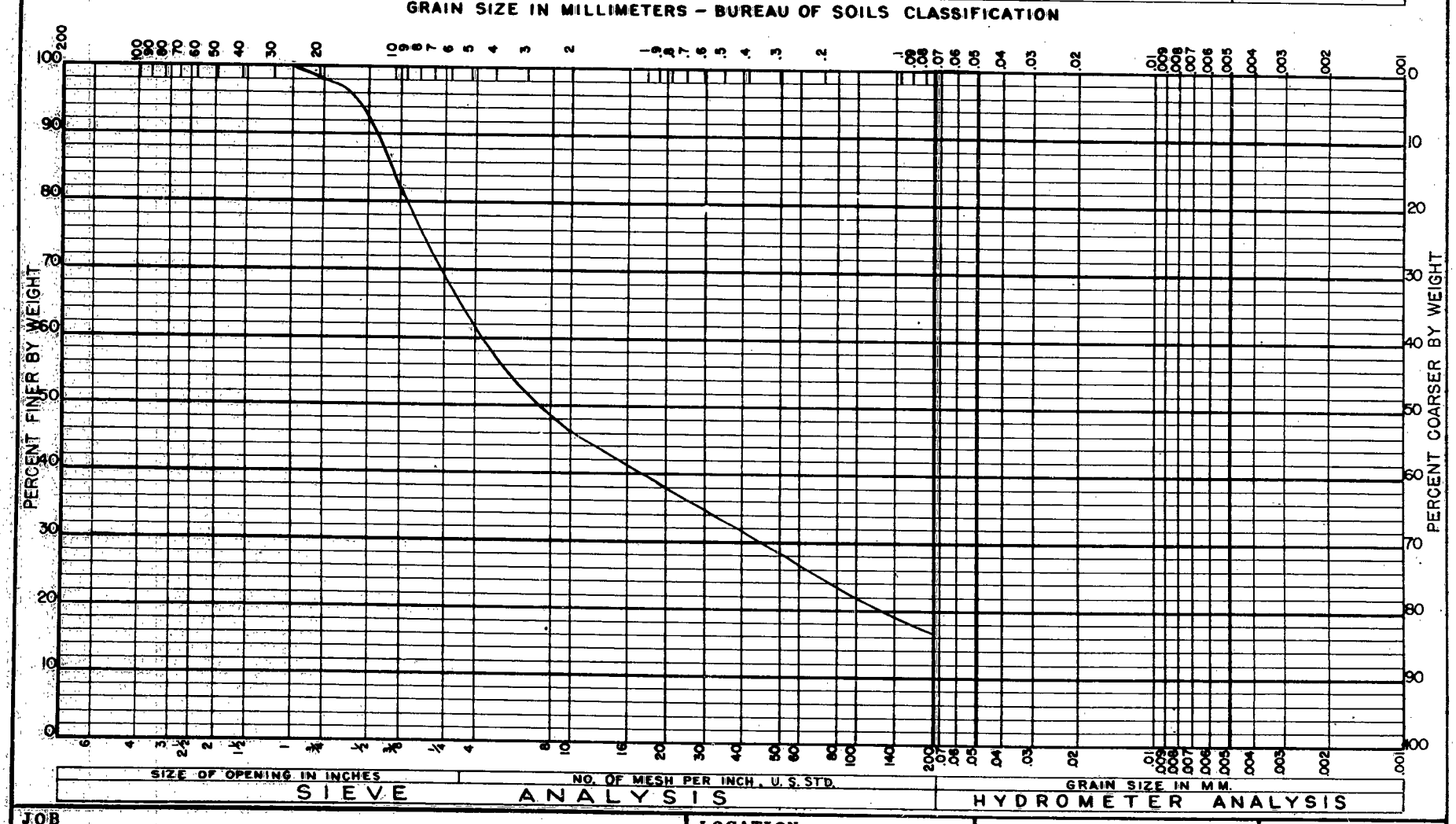
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6 - Sta 6+00	Base	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

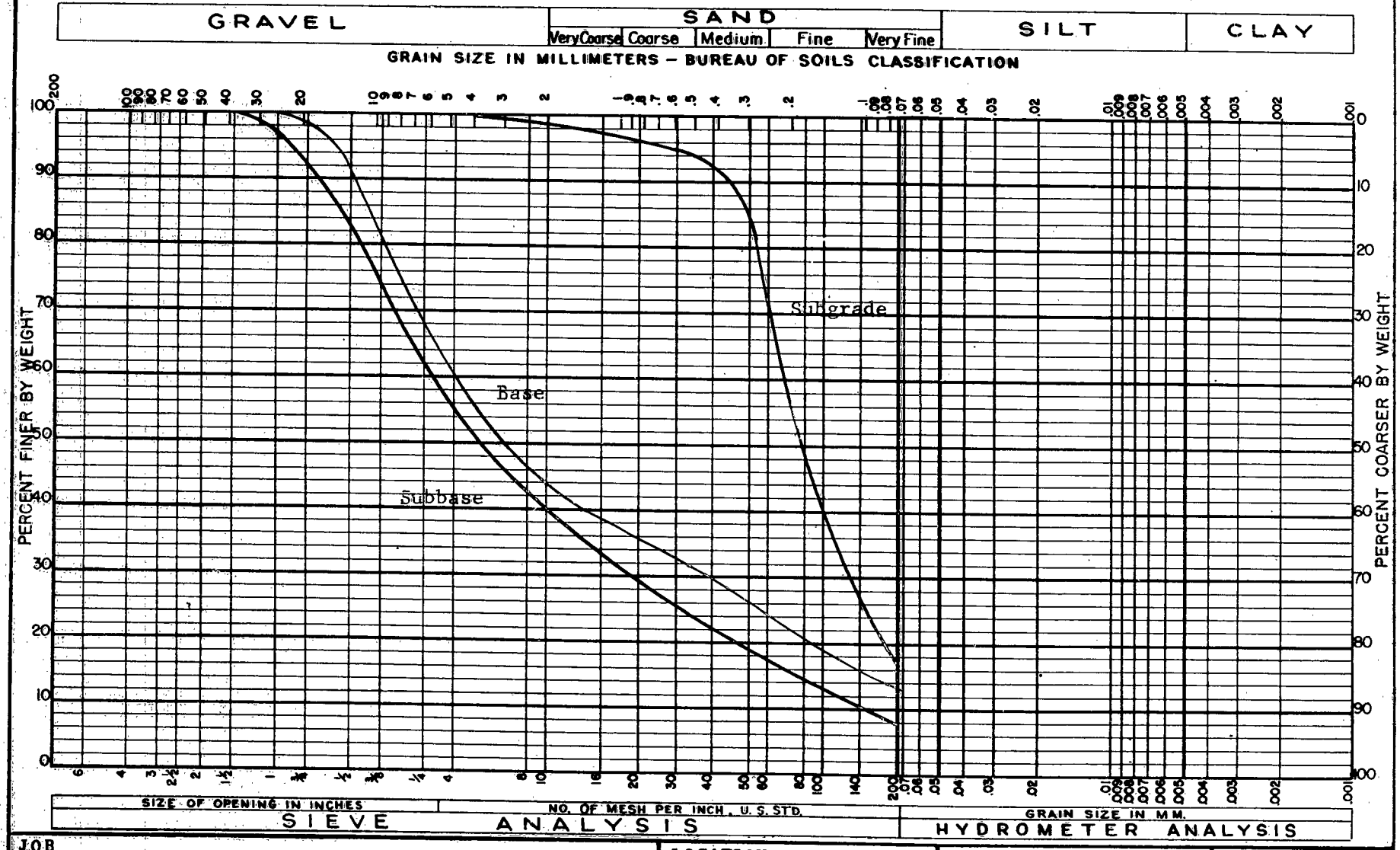
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6 - Sta 6+00	Subbase	KJD	June 1964

IND-NCEL-3960/4 (REV. 7-63)

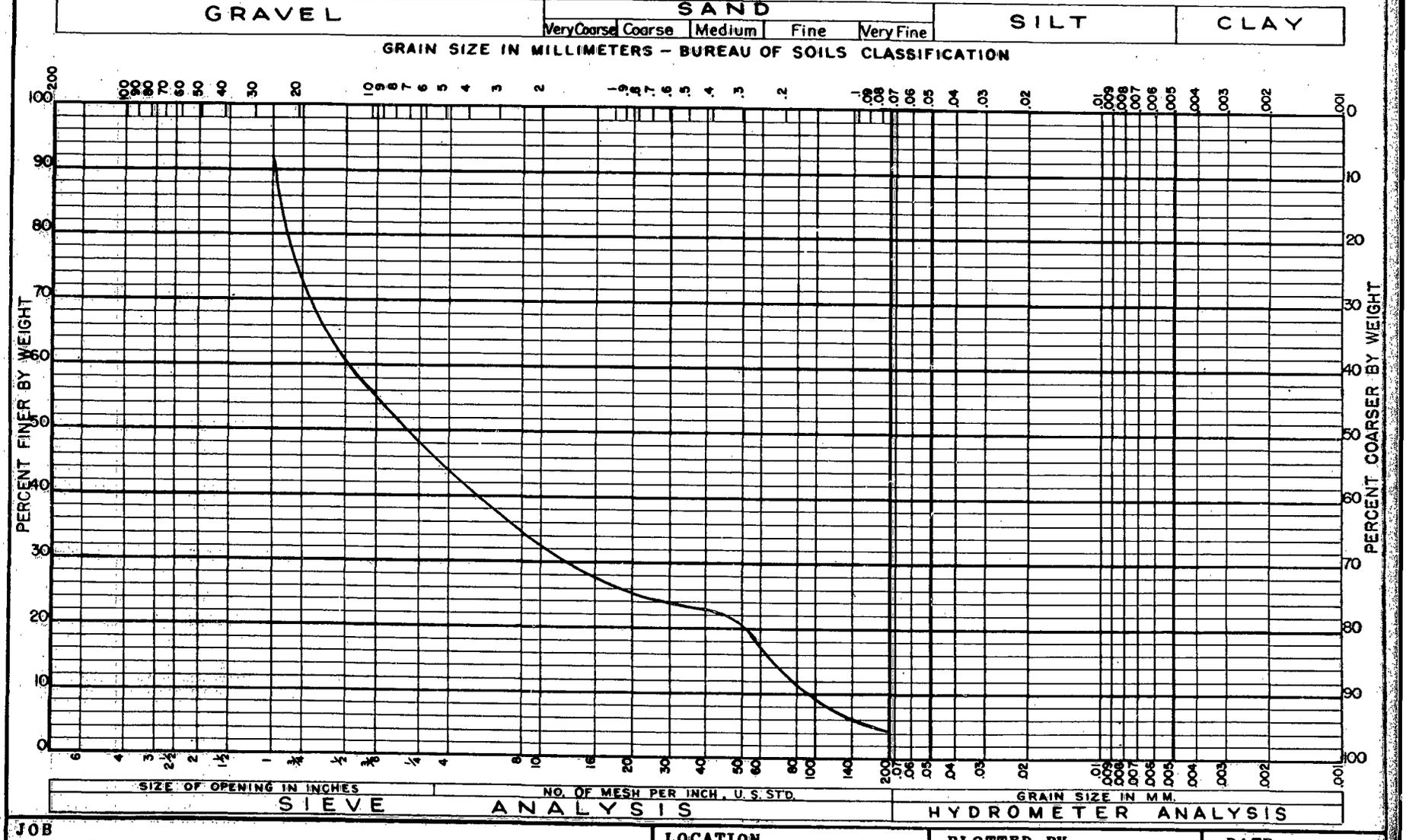
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6 - Sta 14+00	Base, subbase and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

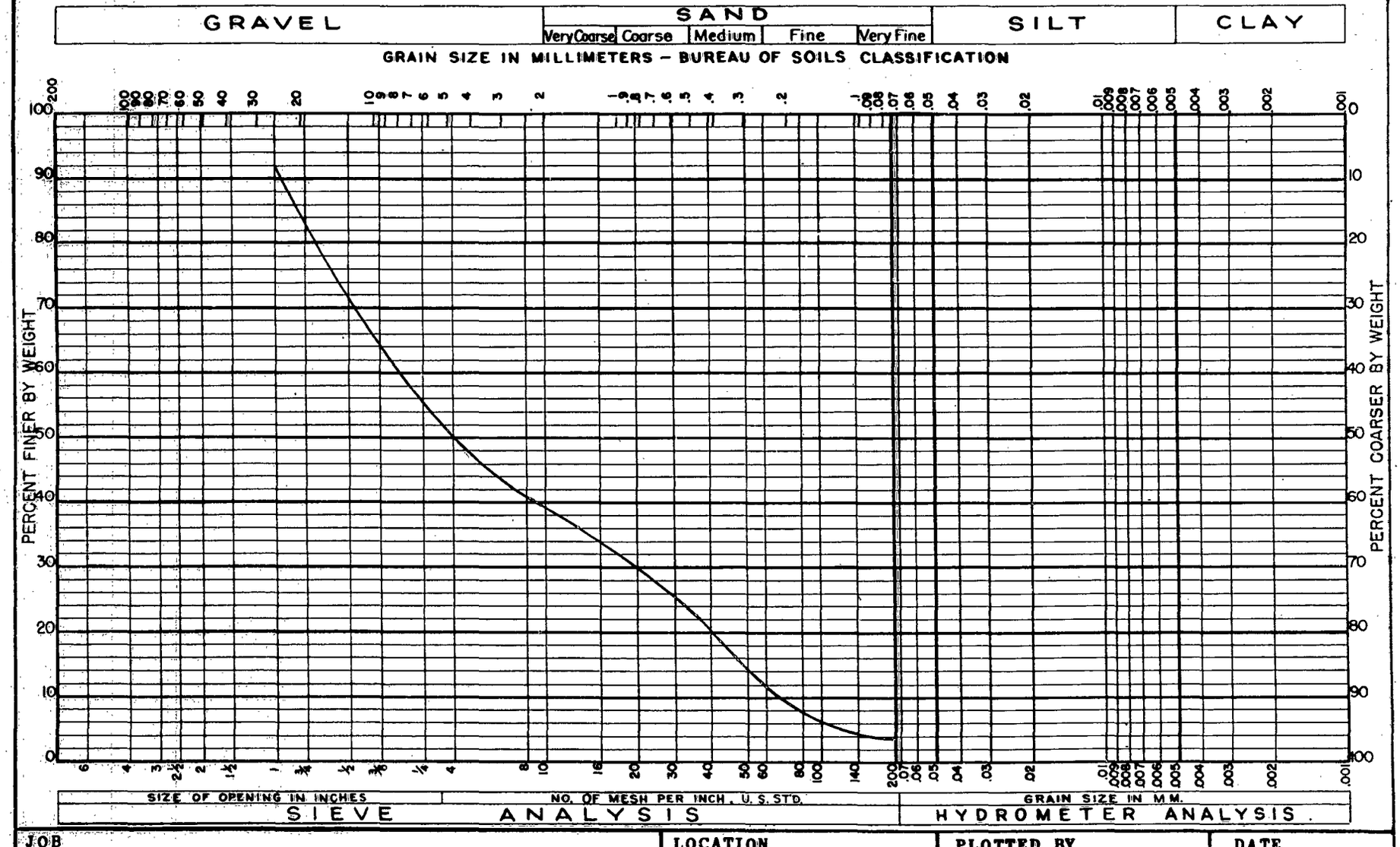
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6A - Sta 6+00	9 inches below top A.C.	KJD	June 1964

IND-NCEL-3960/4 (REV. 7-63)

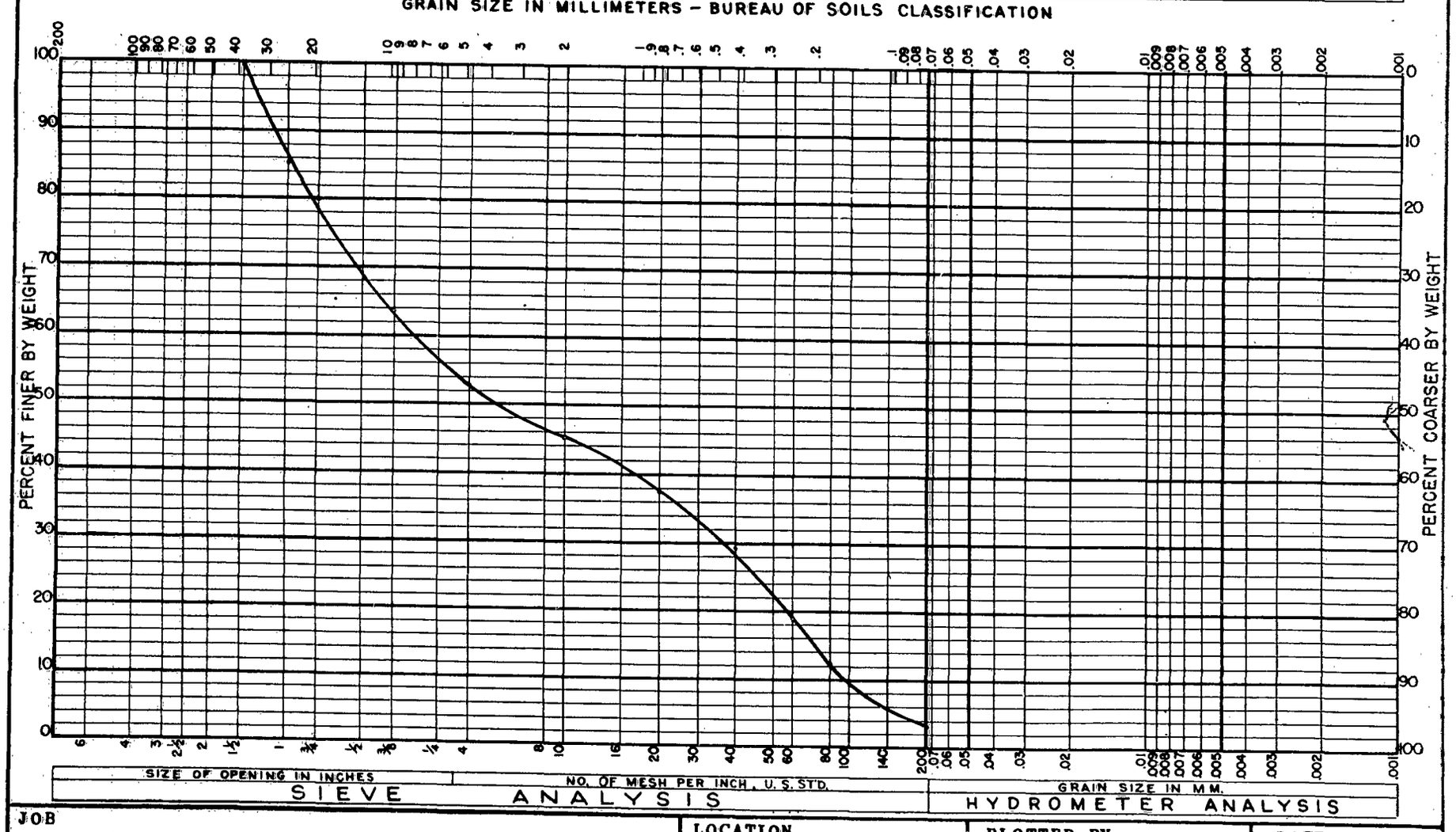
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6A - Sta 16+00	9 inches below top A.C.	KJD	June 1964

IND-NCEL-3960/4 (REV. 7-63)

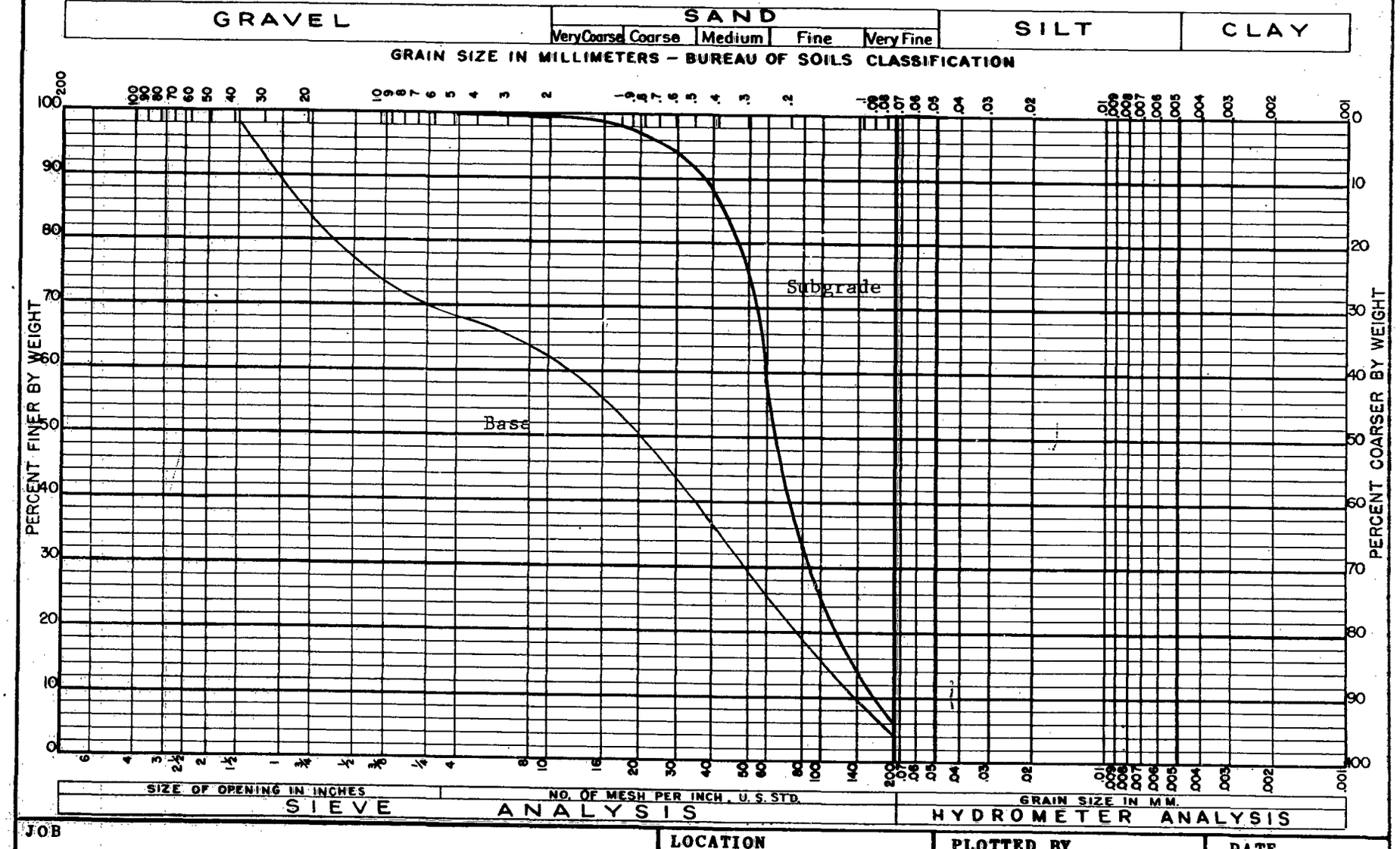
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Taxiway 6A - Sta 16+00	Subgrade	RET	June 1964

1 IND-NCEL-3960/4 (REV. 7-63)

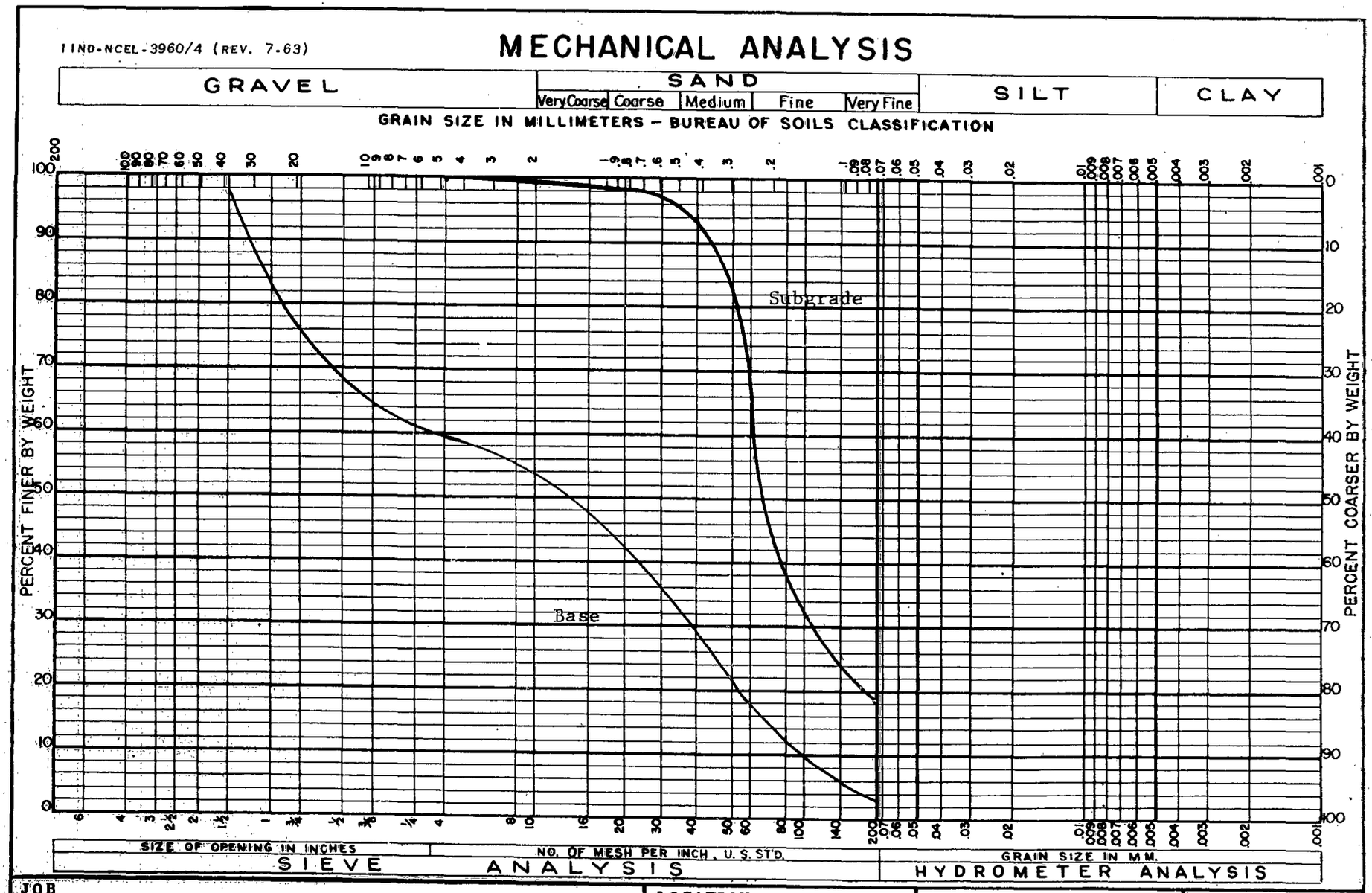
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 17-35 - Sta 7+00	Base and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

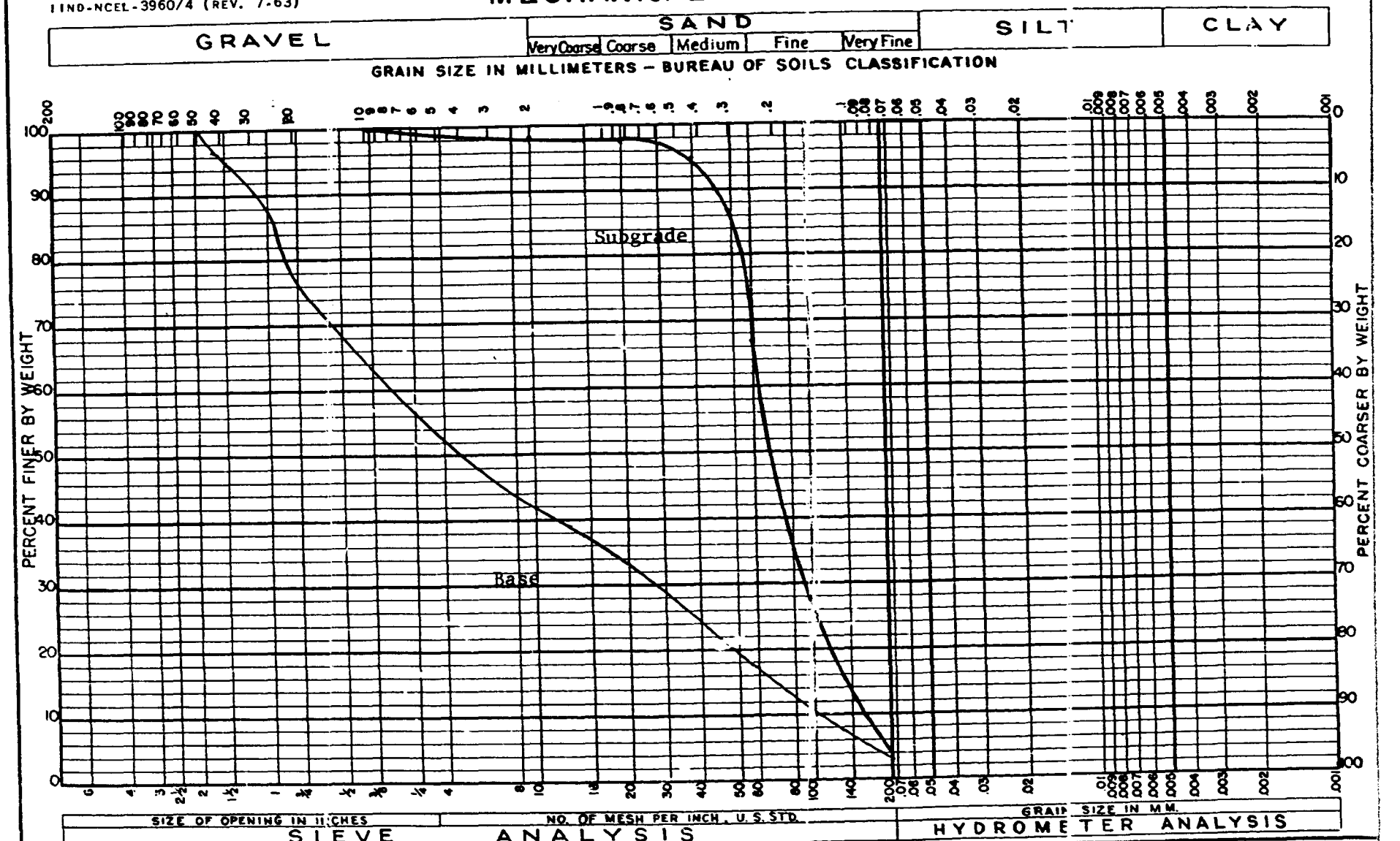
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 17-35 - Sta 19+00	Base and subgrade	KJD and RET	June 1964

MECHANICAL ANALYSIS

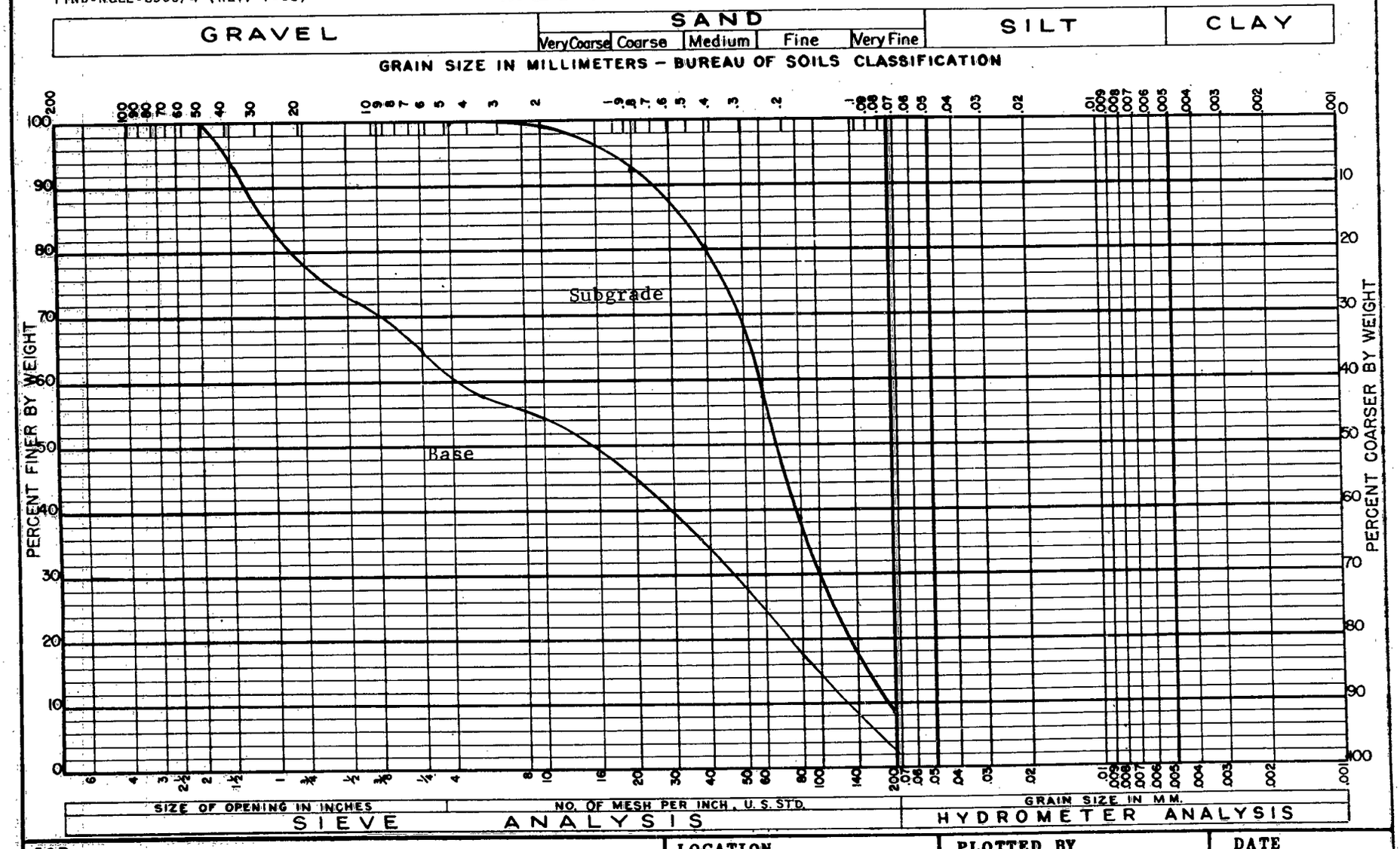
IND-NCEL-3960/4 (REV. 7-63)



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 17-35 - Sta 29+00	Base and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

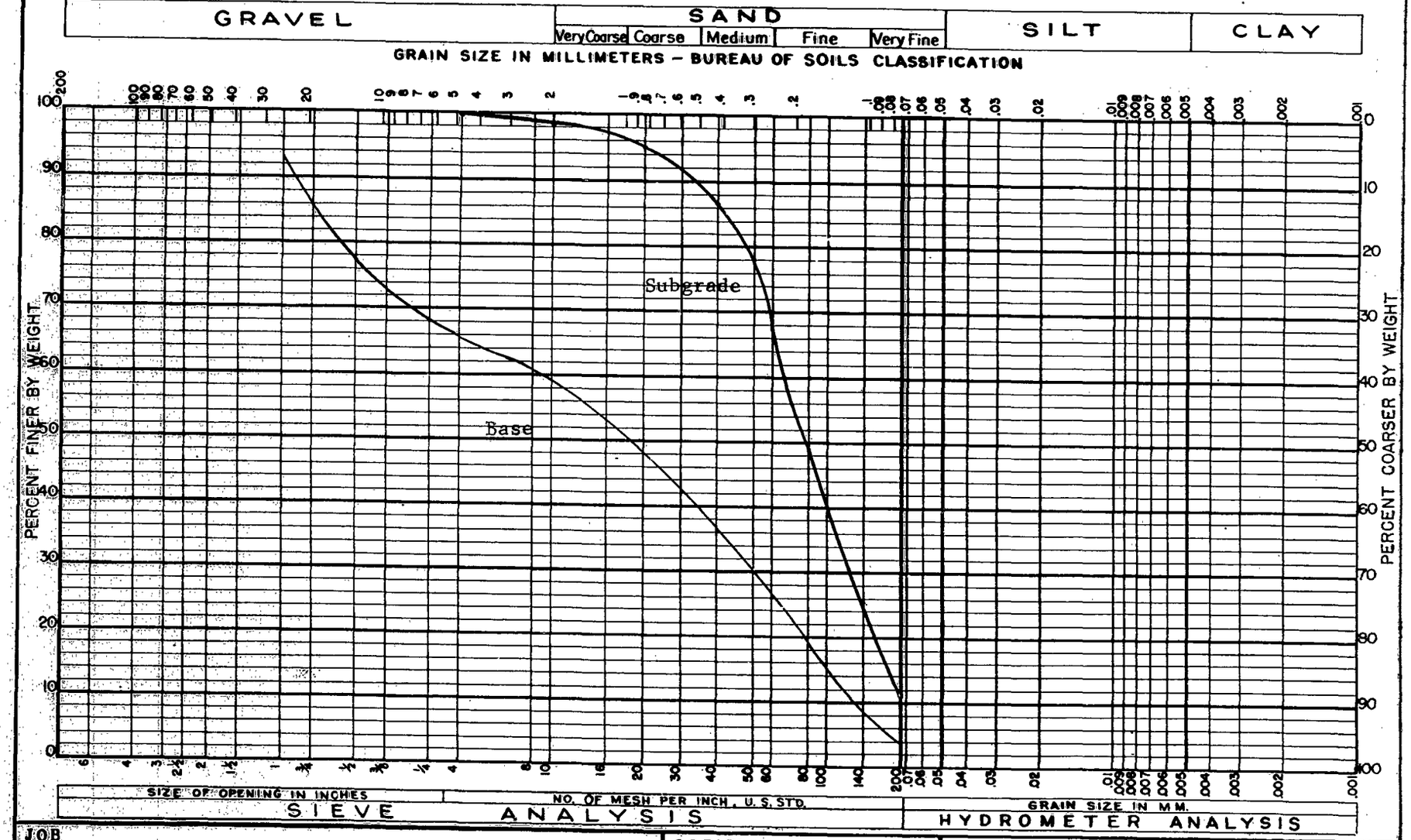
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 17-35 - Sta 39+00	Base and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

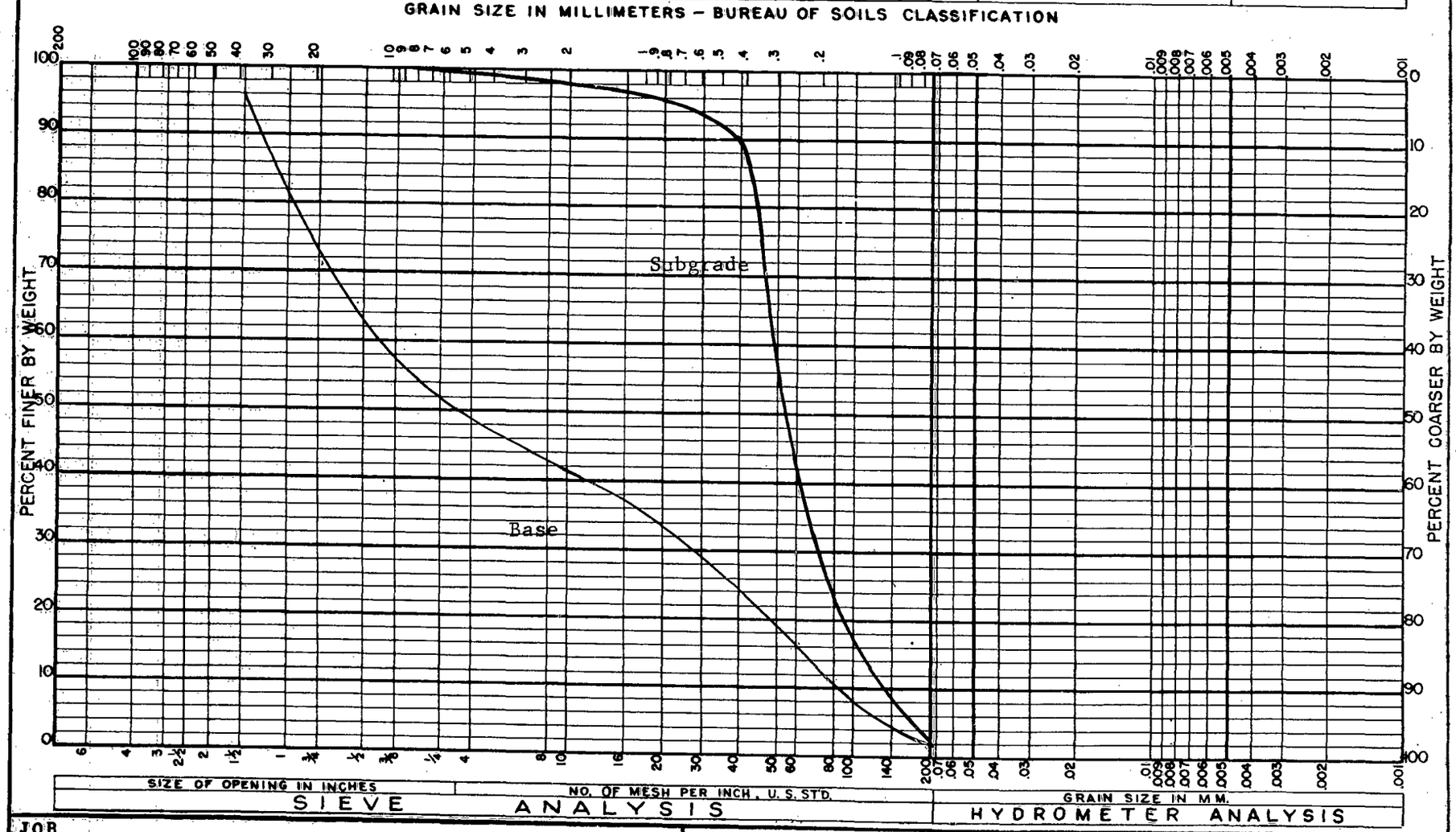
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 17-35 - Sta 49+00	Base and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

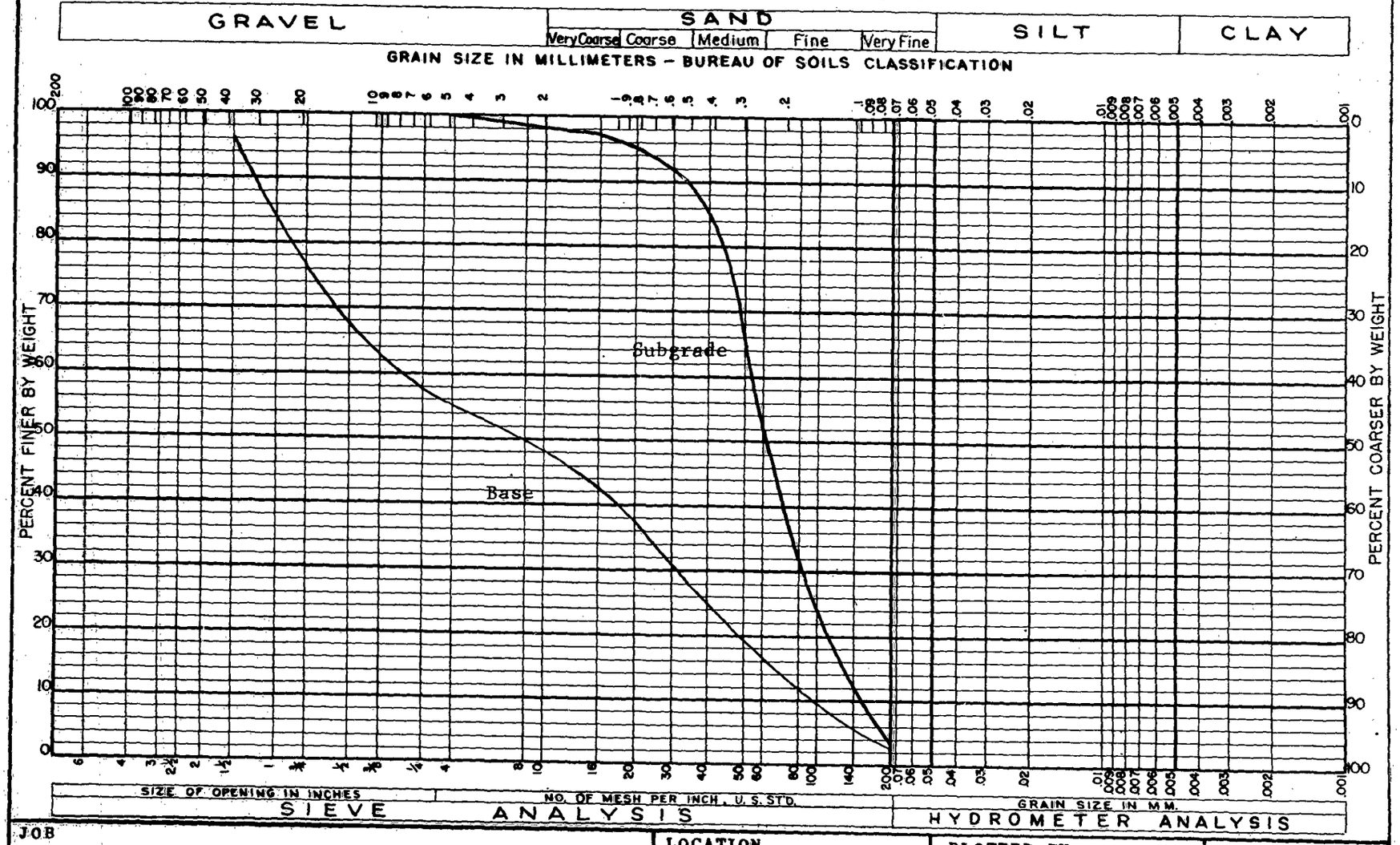
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 6+00	Base course and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

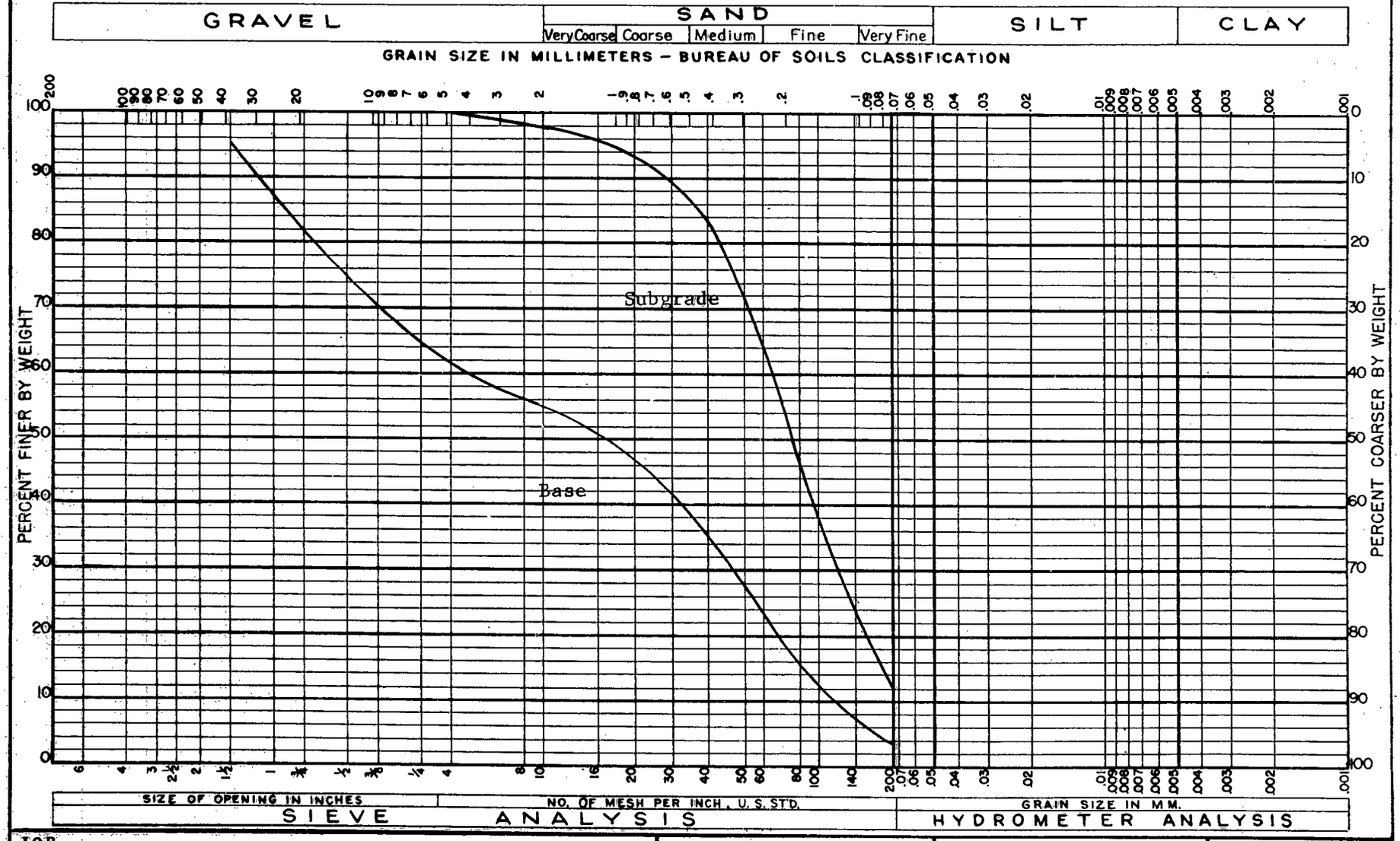
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 16+00	Base course and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

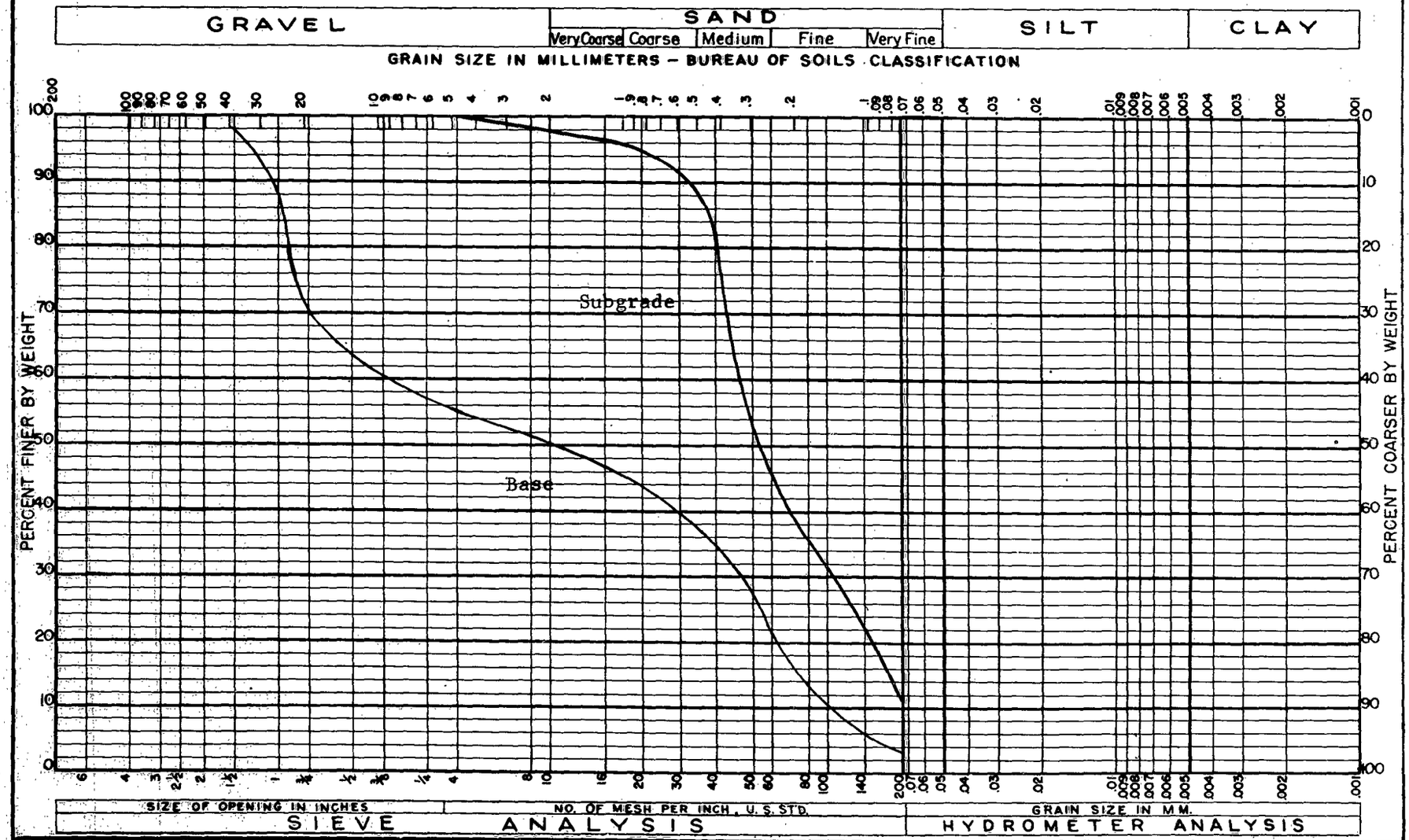
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 26+00	Base course and subgrade	KJD and RET	June 1964

FIND-NCEL-3960/4 (REV. 7-63)

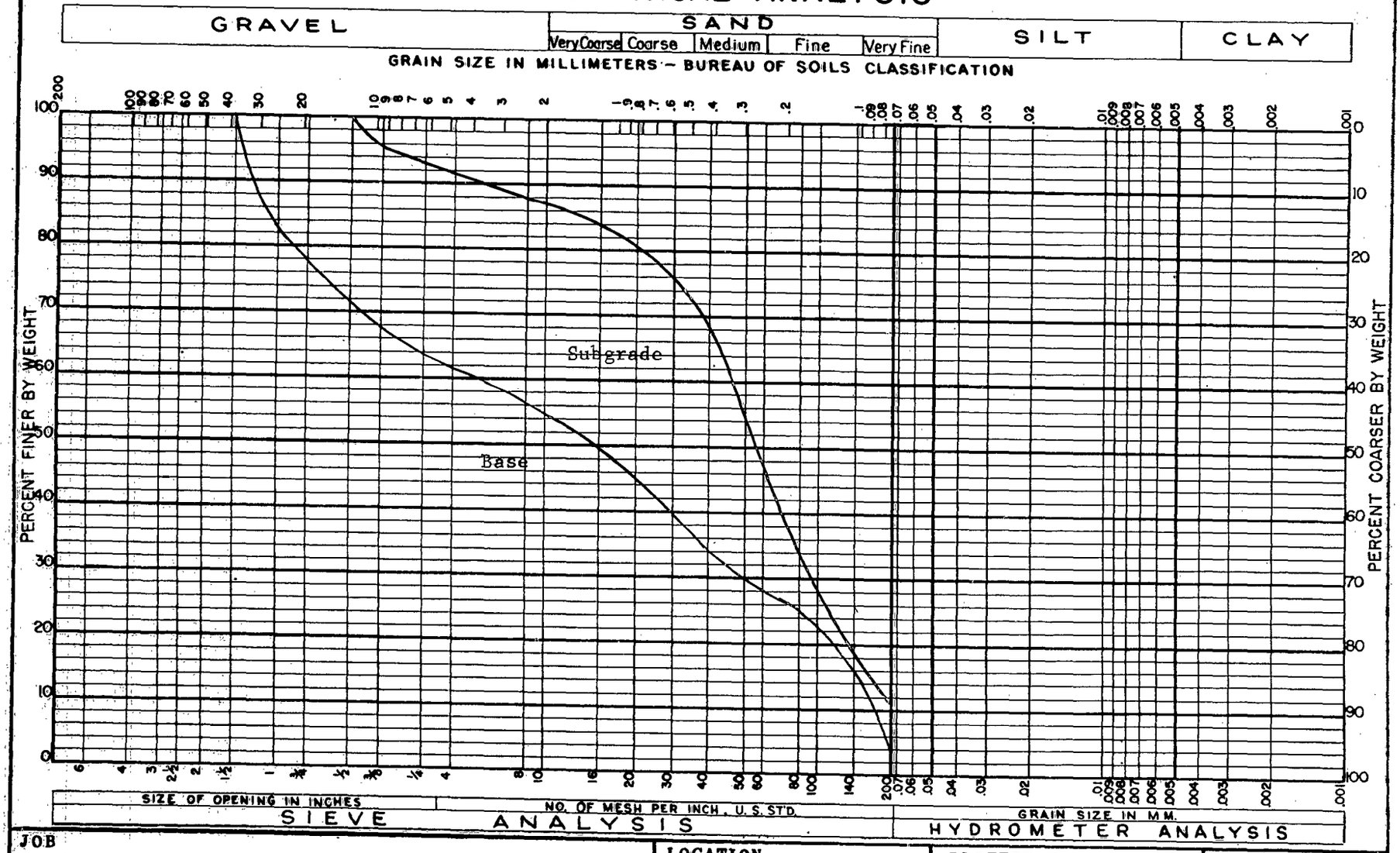
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 36+00	Base course and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

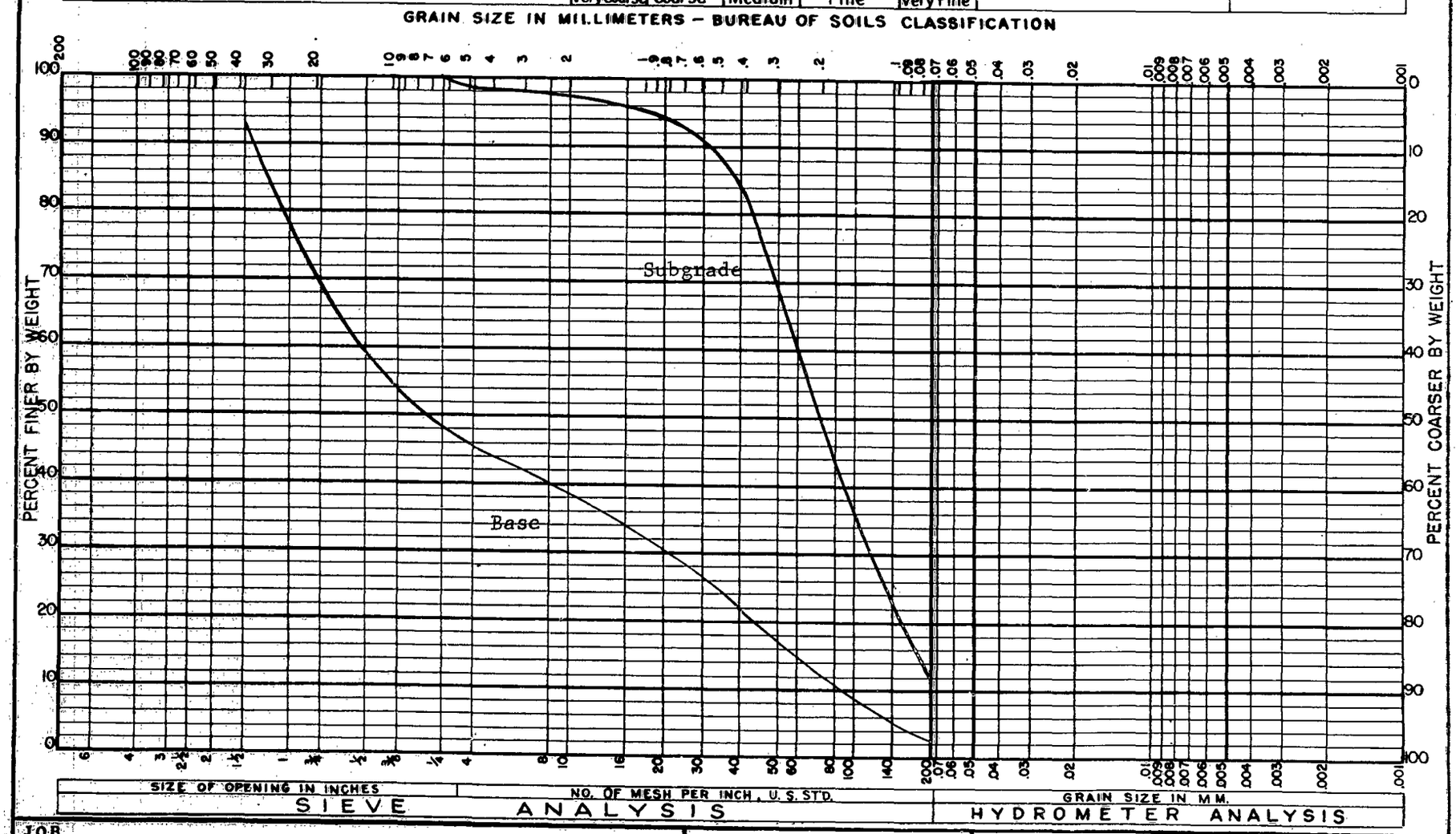
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 46+00	Base course and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

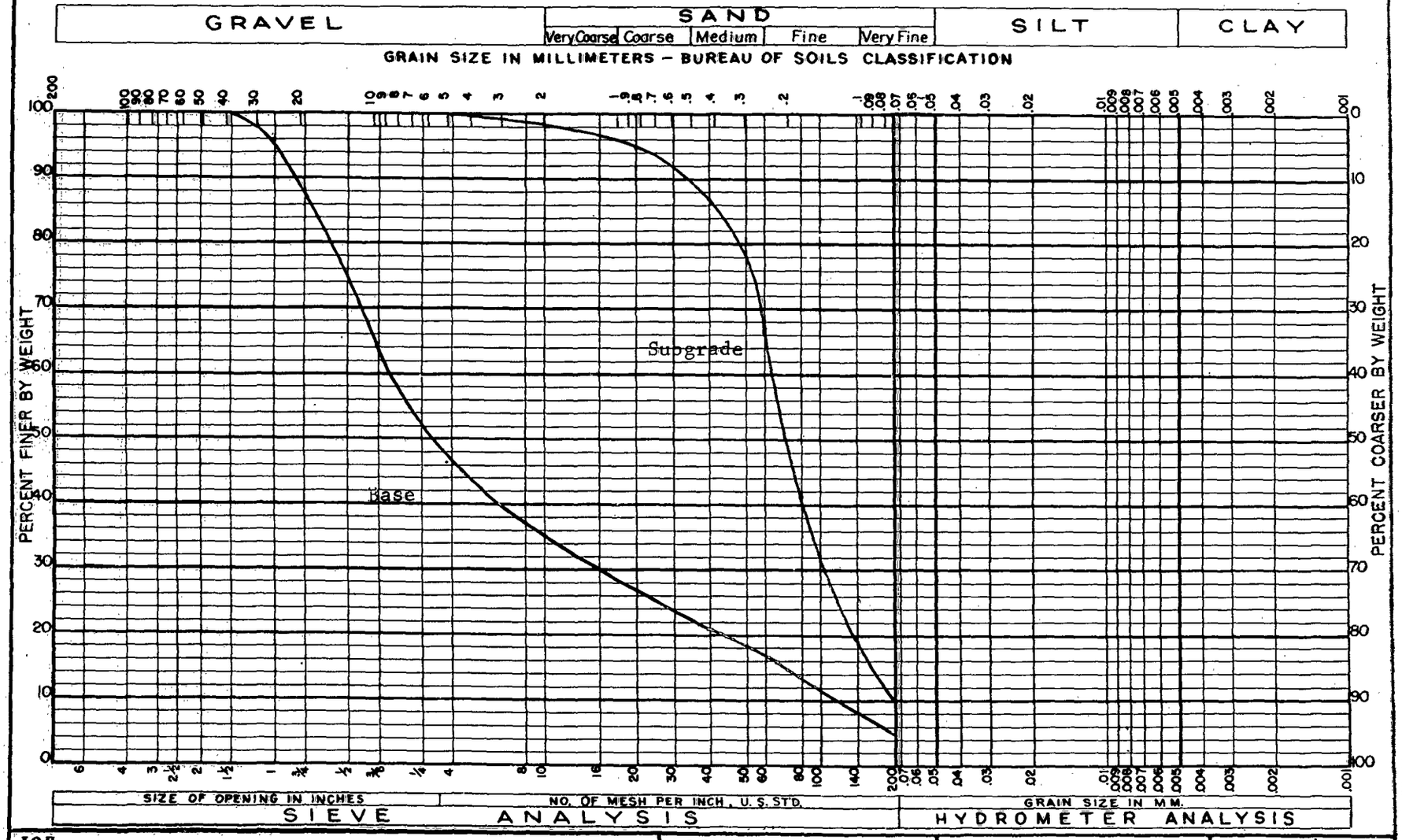
MECHANICAL ANALYSIS



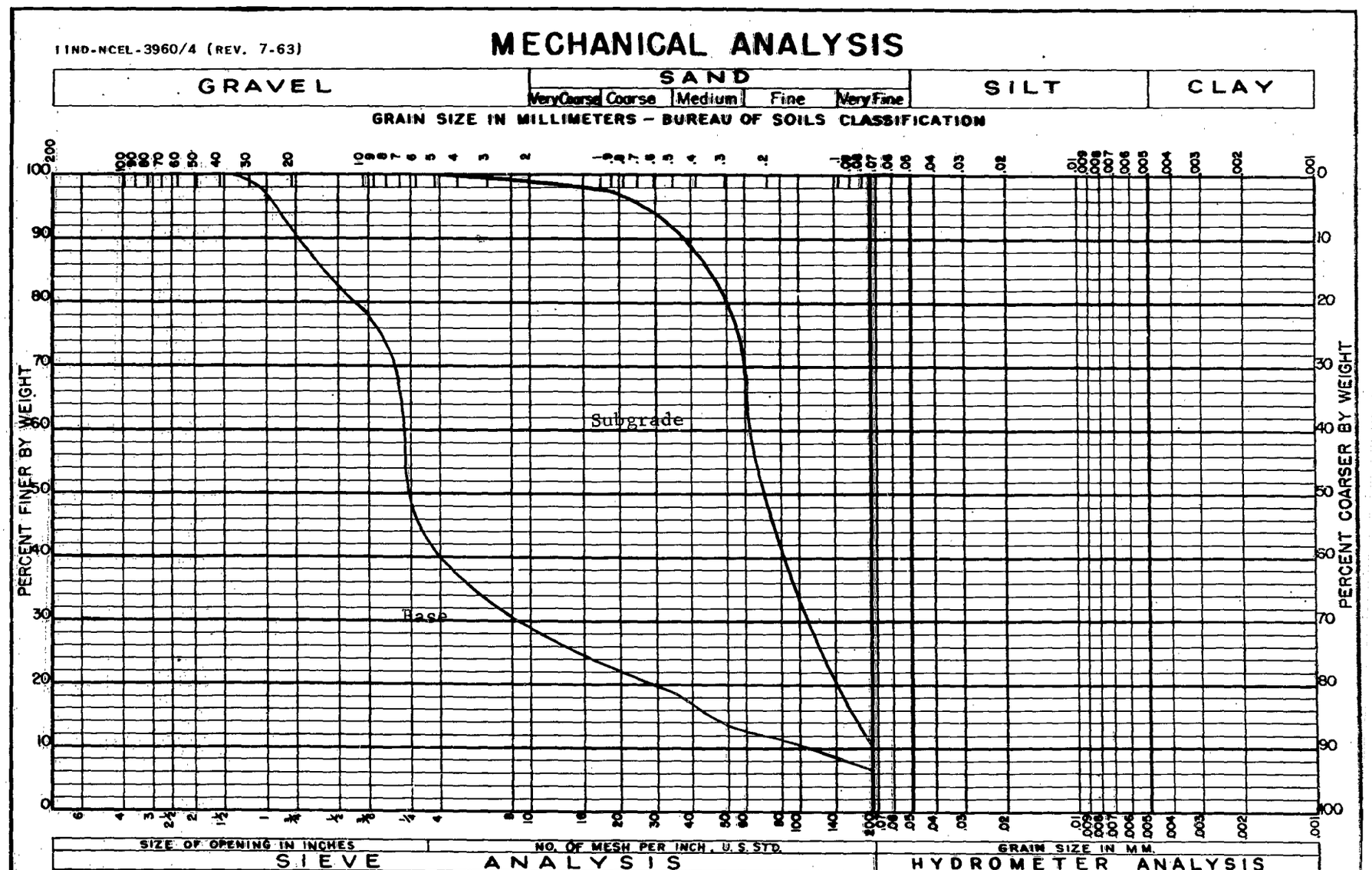
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 08-26 - Sta 56+00	Base course and subgrade	KJD and RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

MECHANICAL ANALYSIS



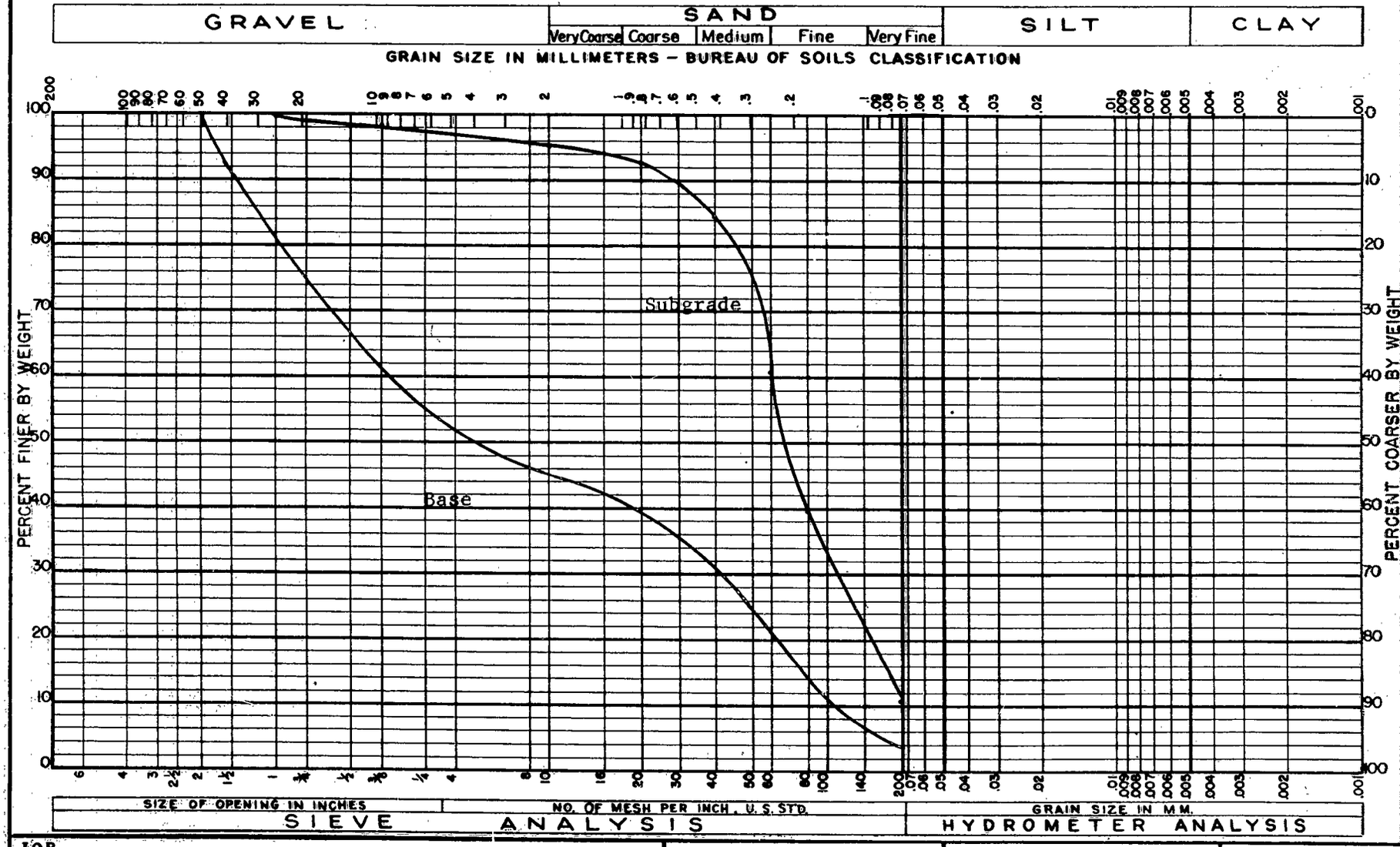
JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 15+50	Base and subgrade	RET	June 1964



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 25+50	Base course and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

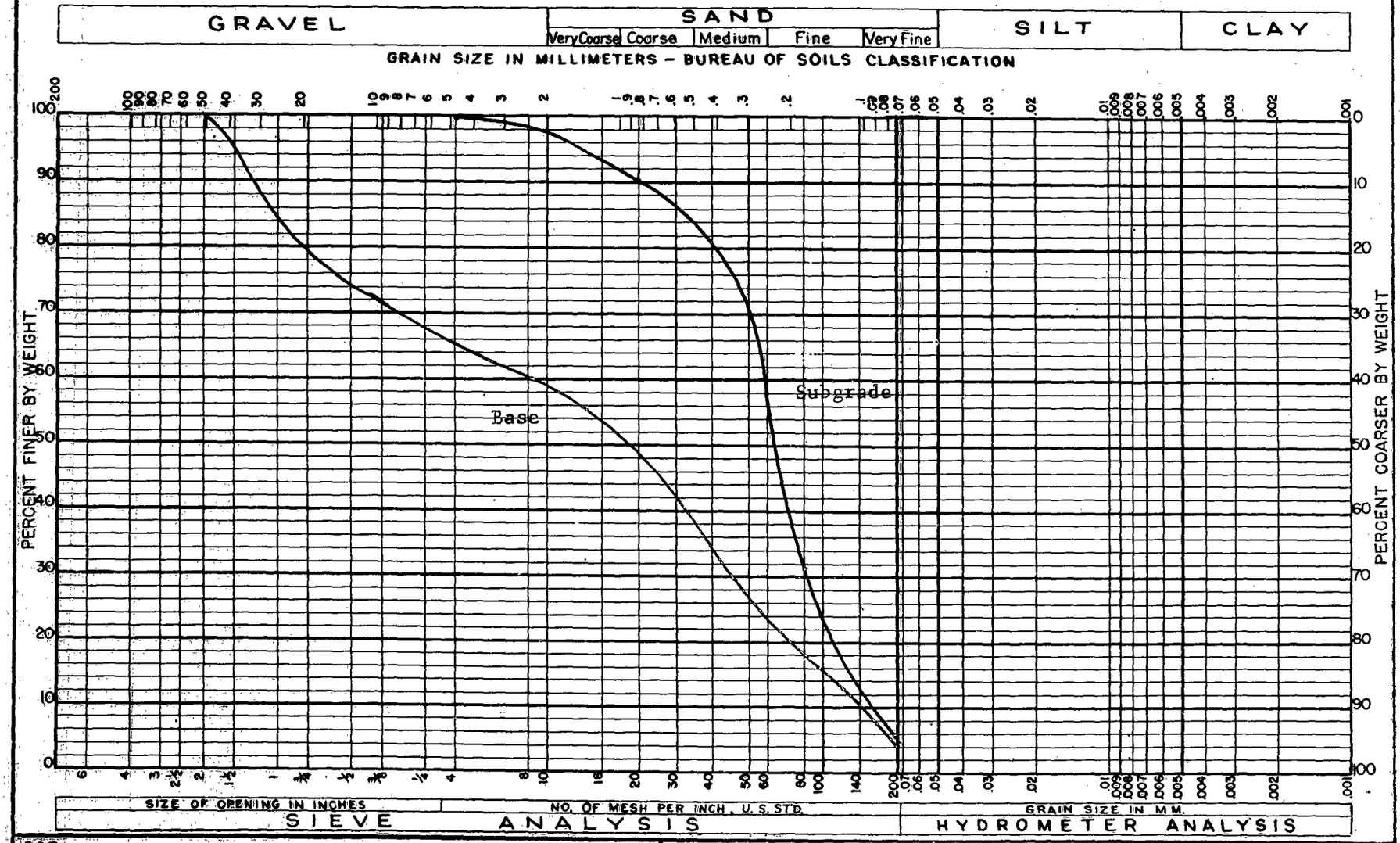
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 35+50	Base and subgrade	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

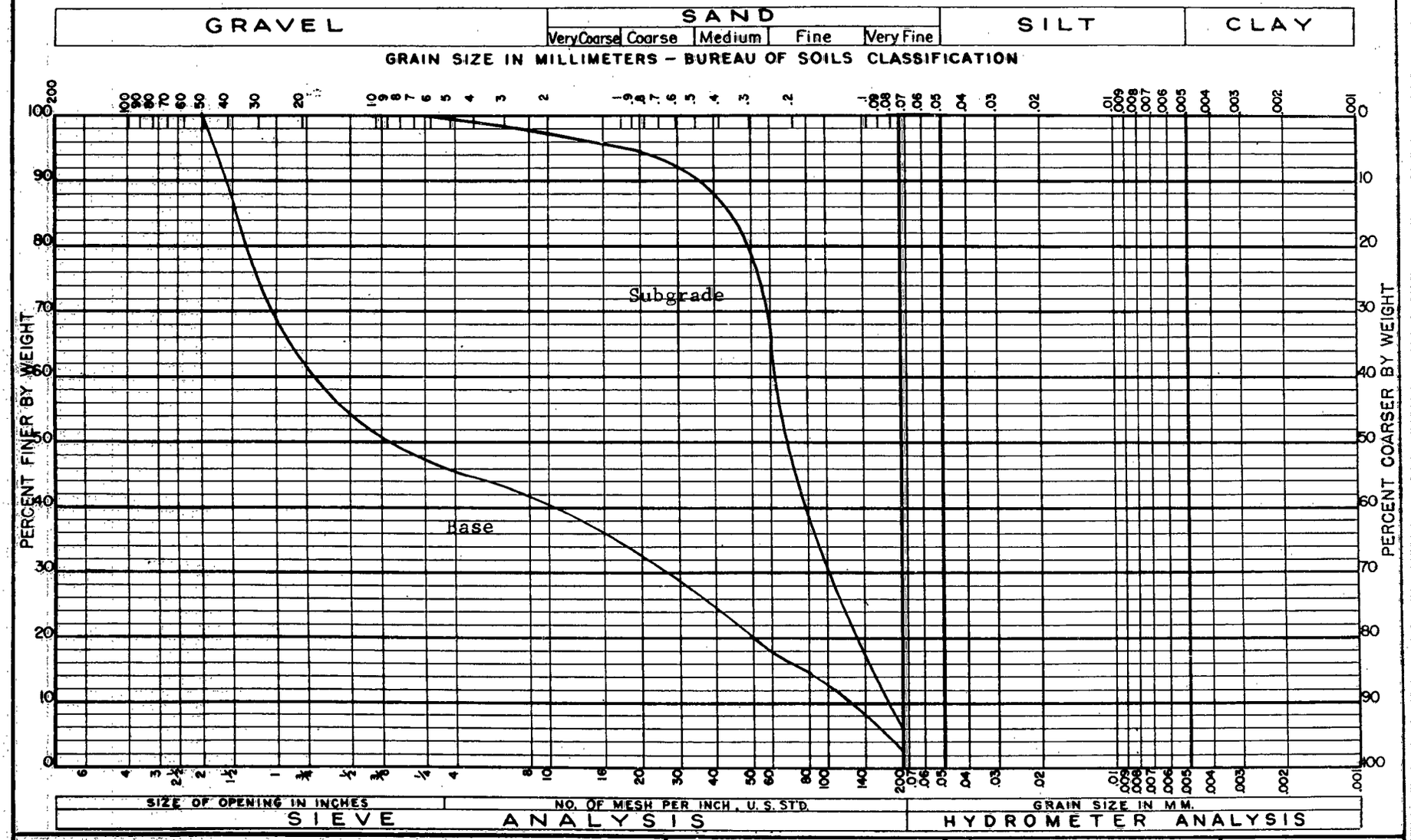
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 45+00	Base and subgrade	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

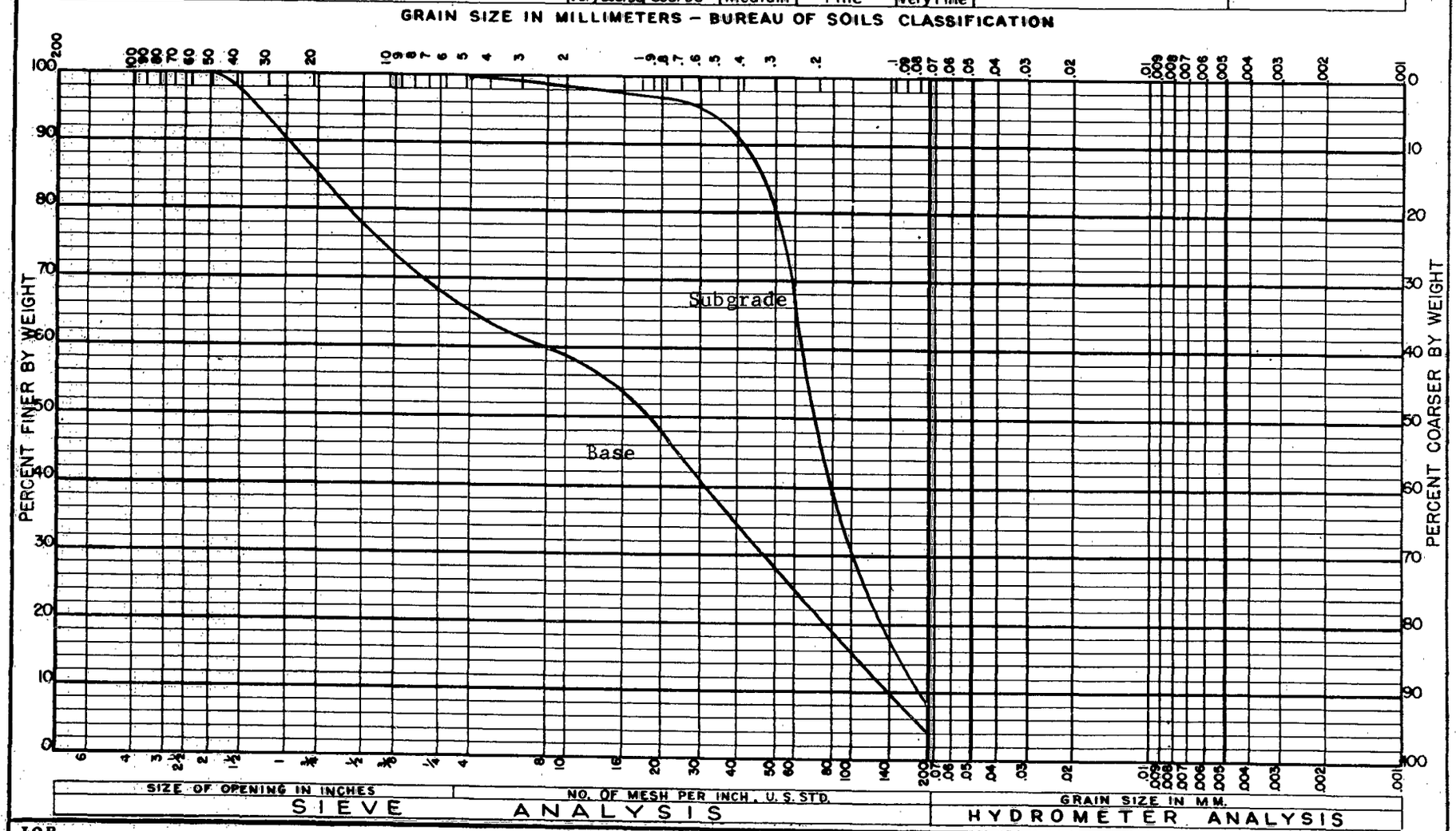
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 55+00	Base course and subgrade	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

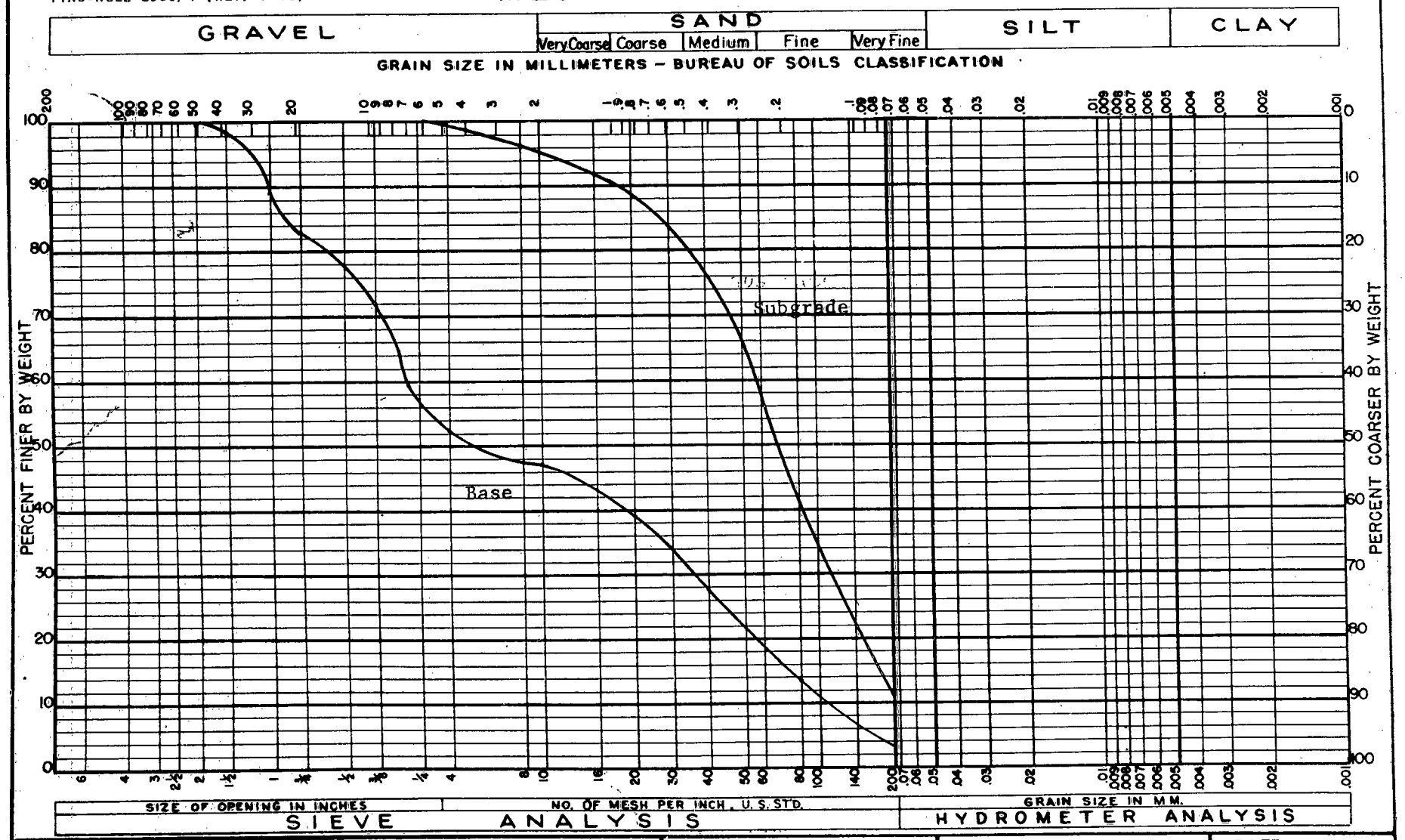
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 65+00	Base and subgrade	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

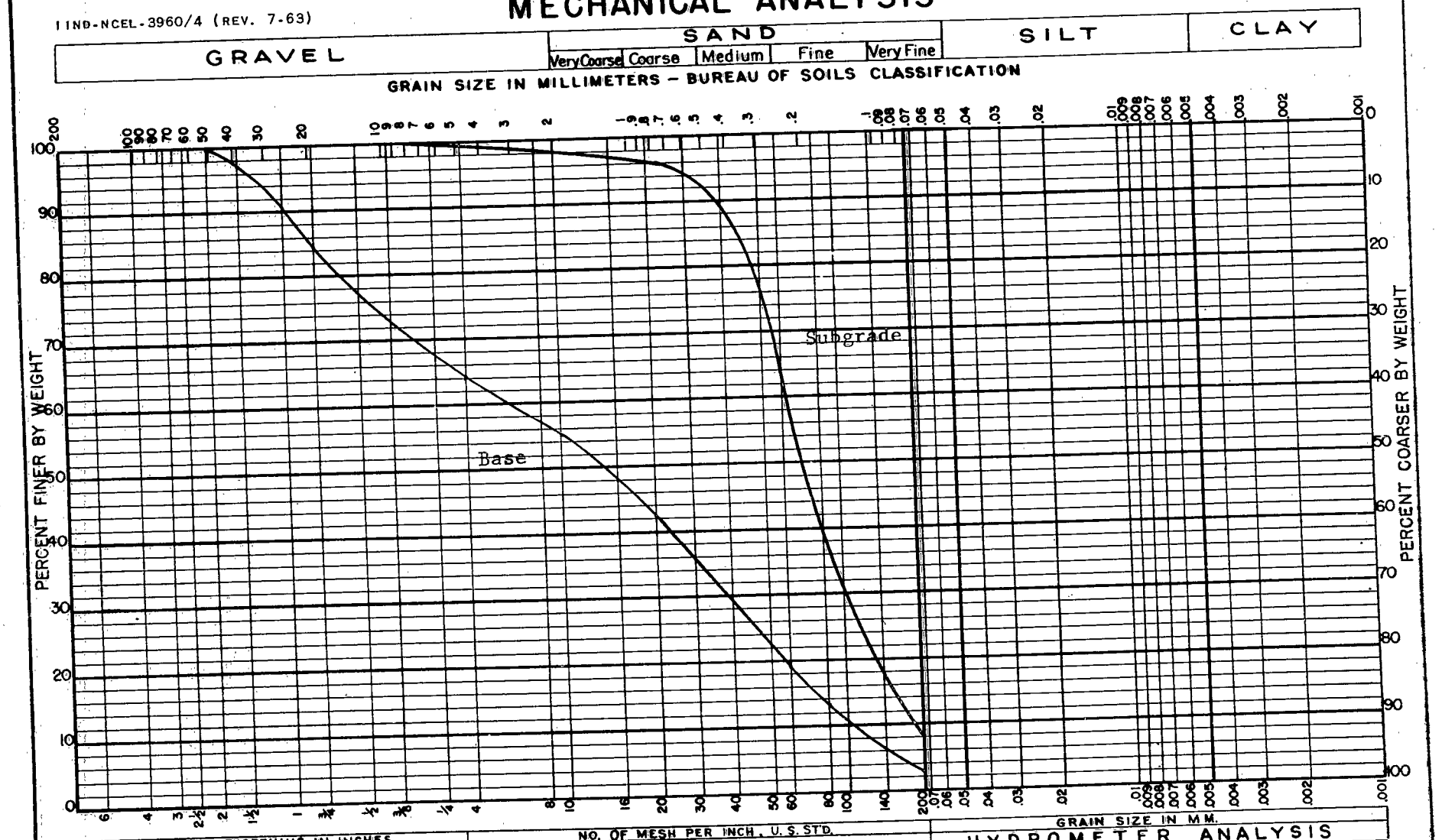
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 75+00	Base course and subgrade	RET	June 1964

MECHANICAL ANALYSIS

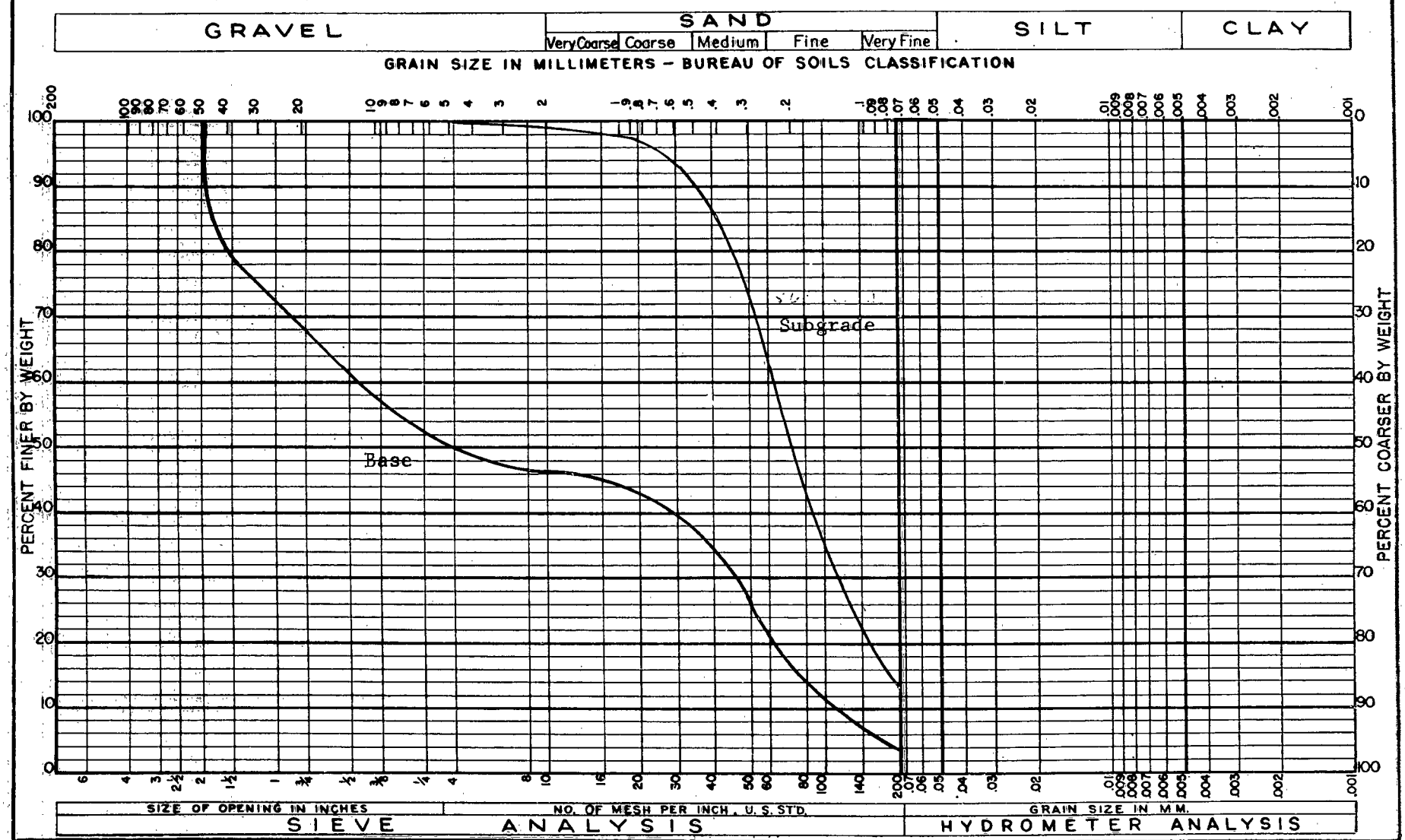
IND-NCEL-3960/4 (REV. 7-63)



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 85+00	Base course and subgrade	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

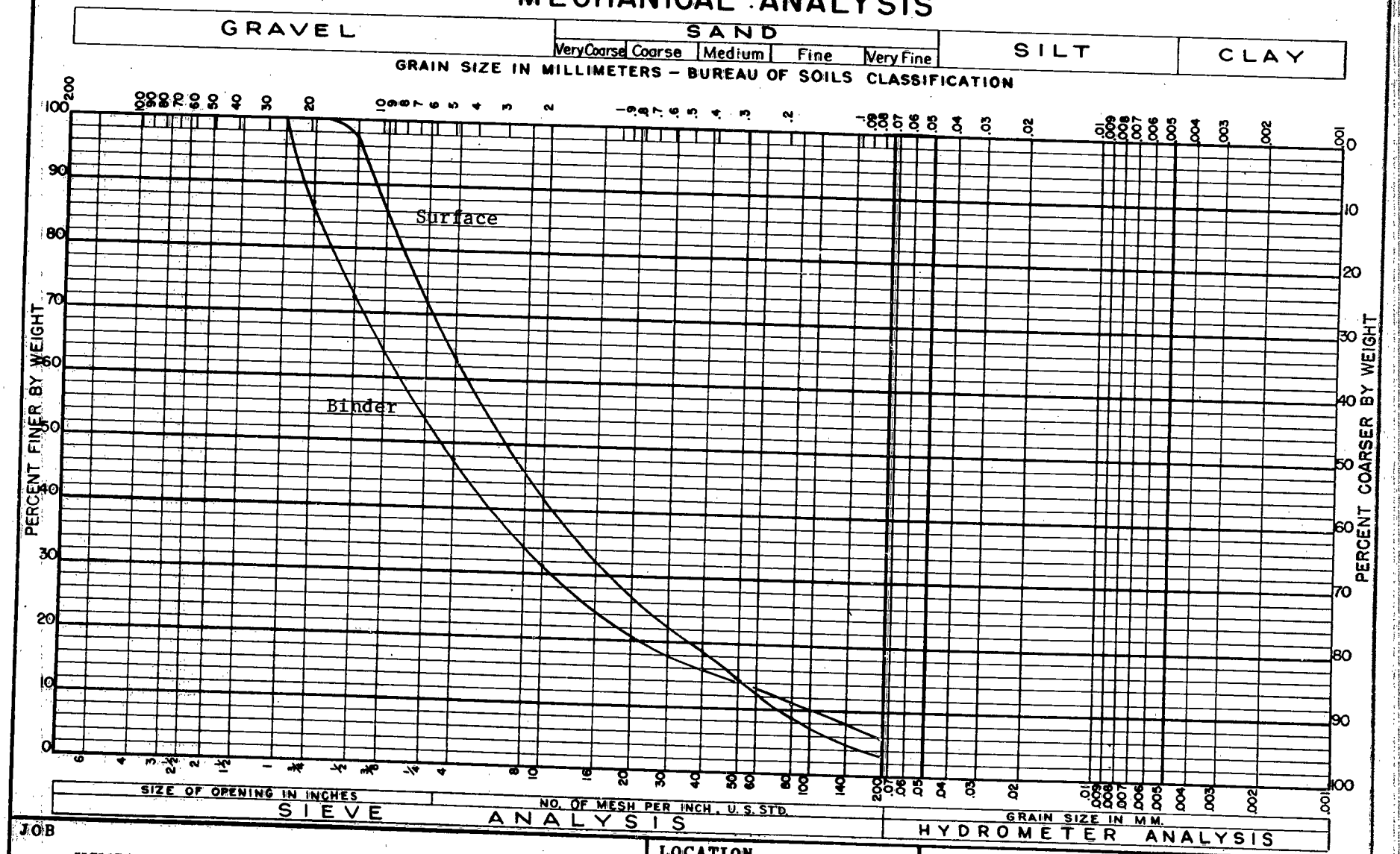
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Runway 03R-21L - Sta 93+50	Subgrade and Base	KJD and RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

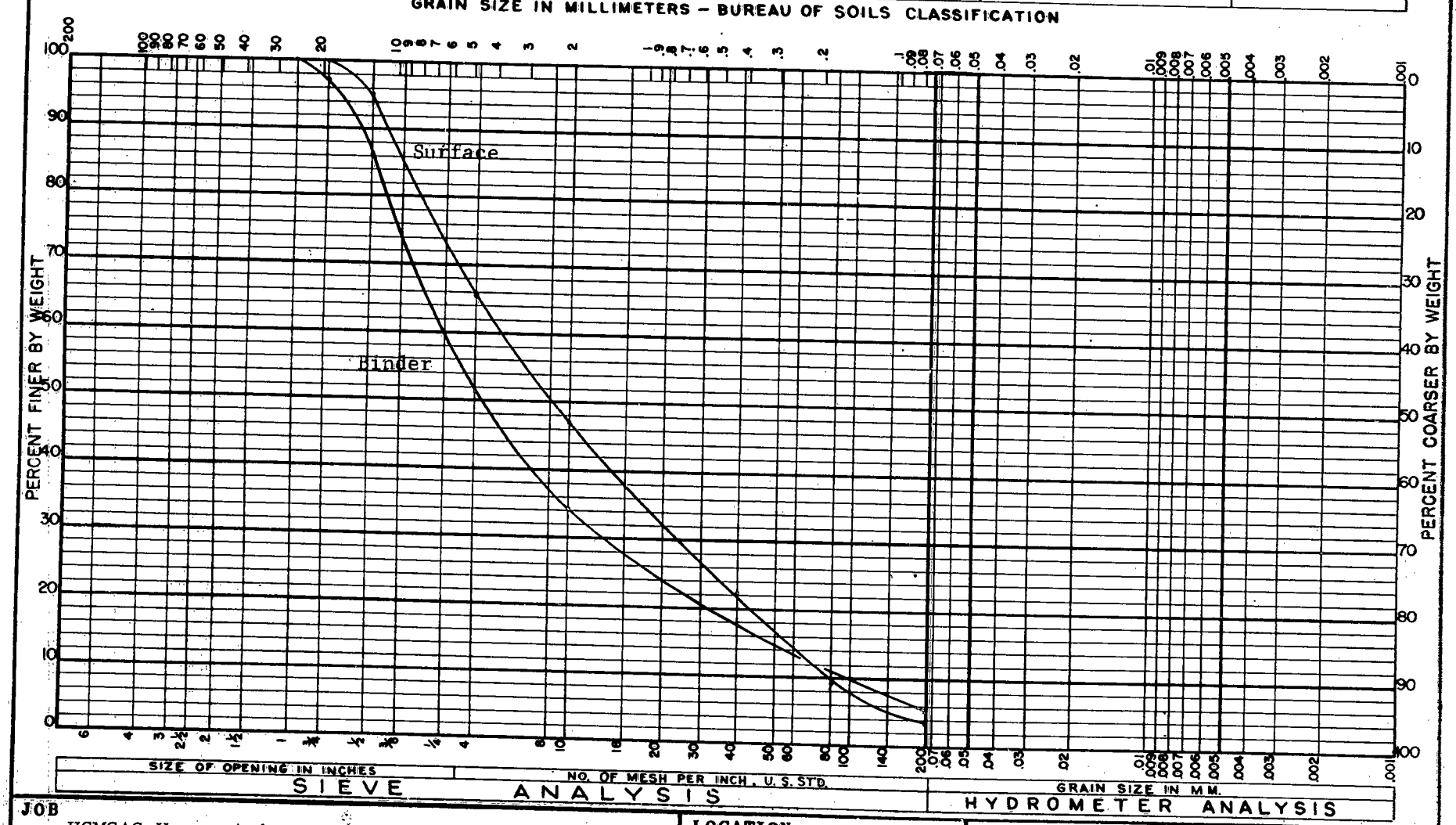
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 15+50 Surface and Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

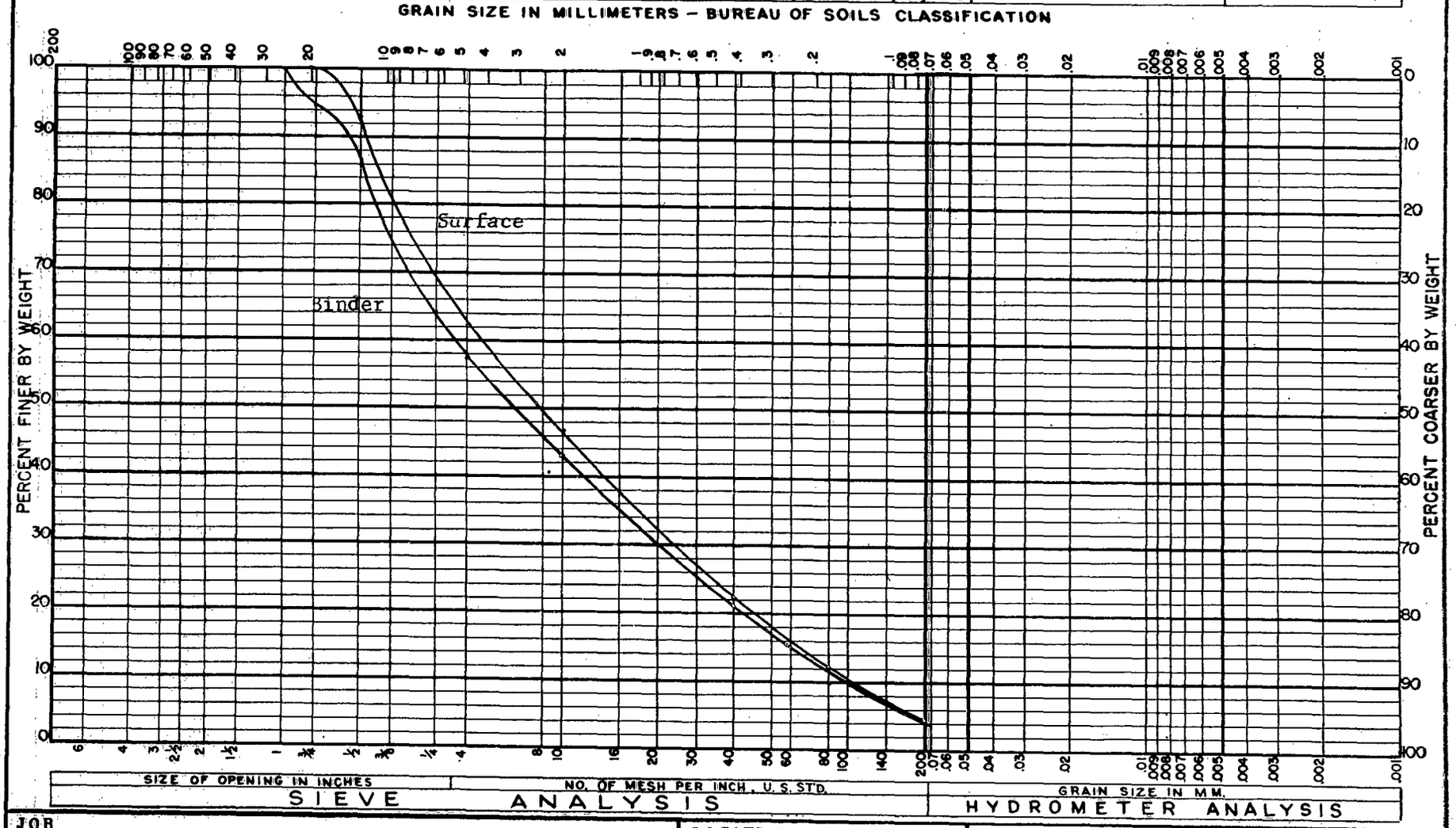
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 25+50 Surface & Binder	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

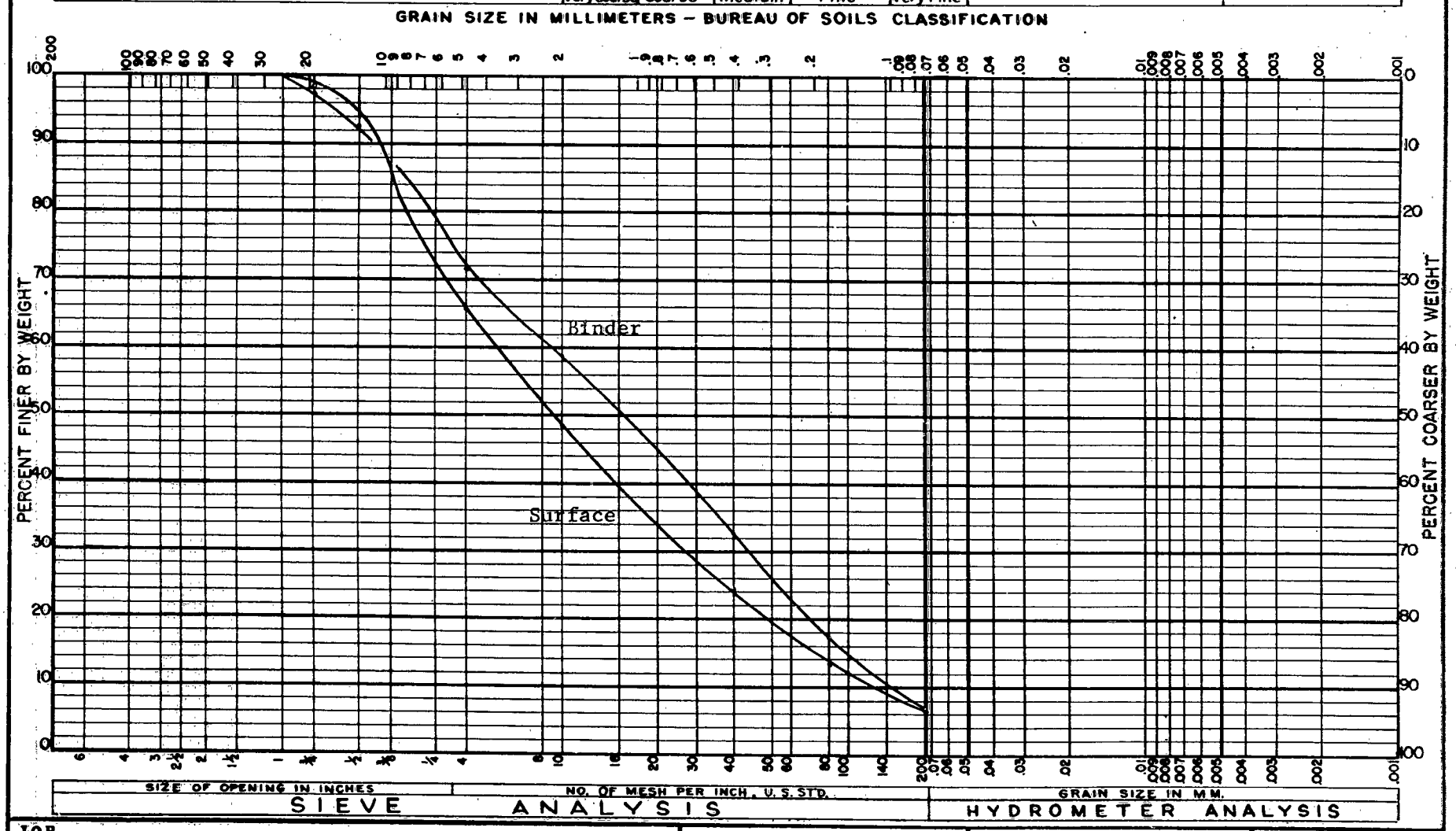
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 35+50 Surface & Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

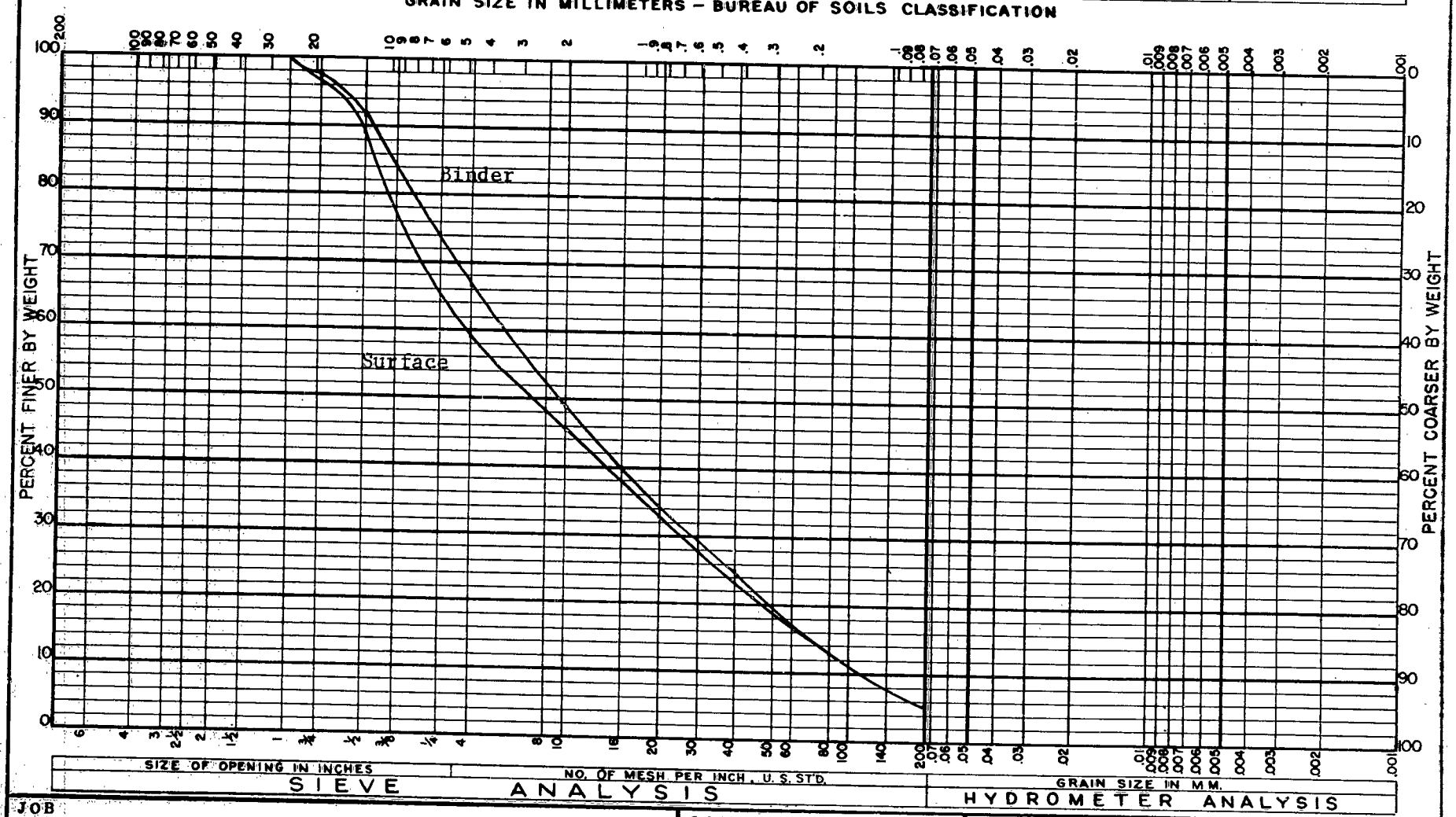
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 45+00 Surface & Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

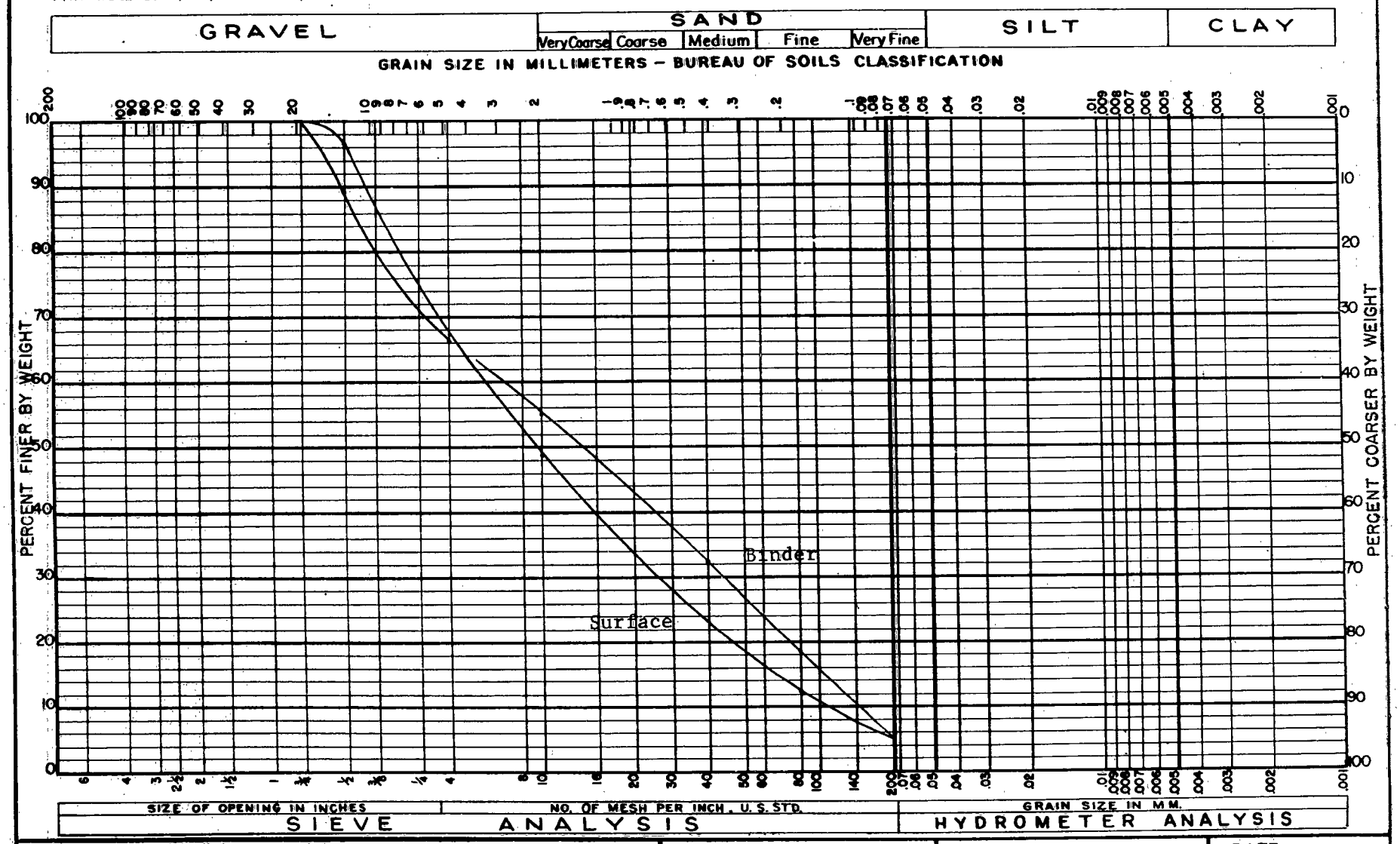
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 55+00 Surface & Binder	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

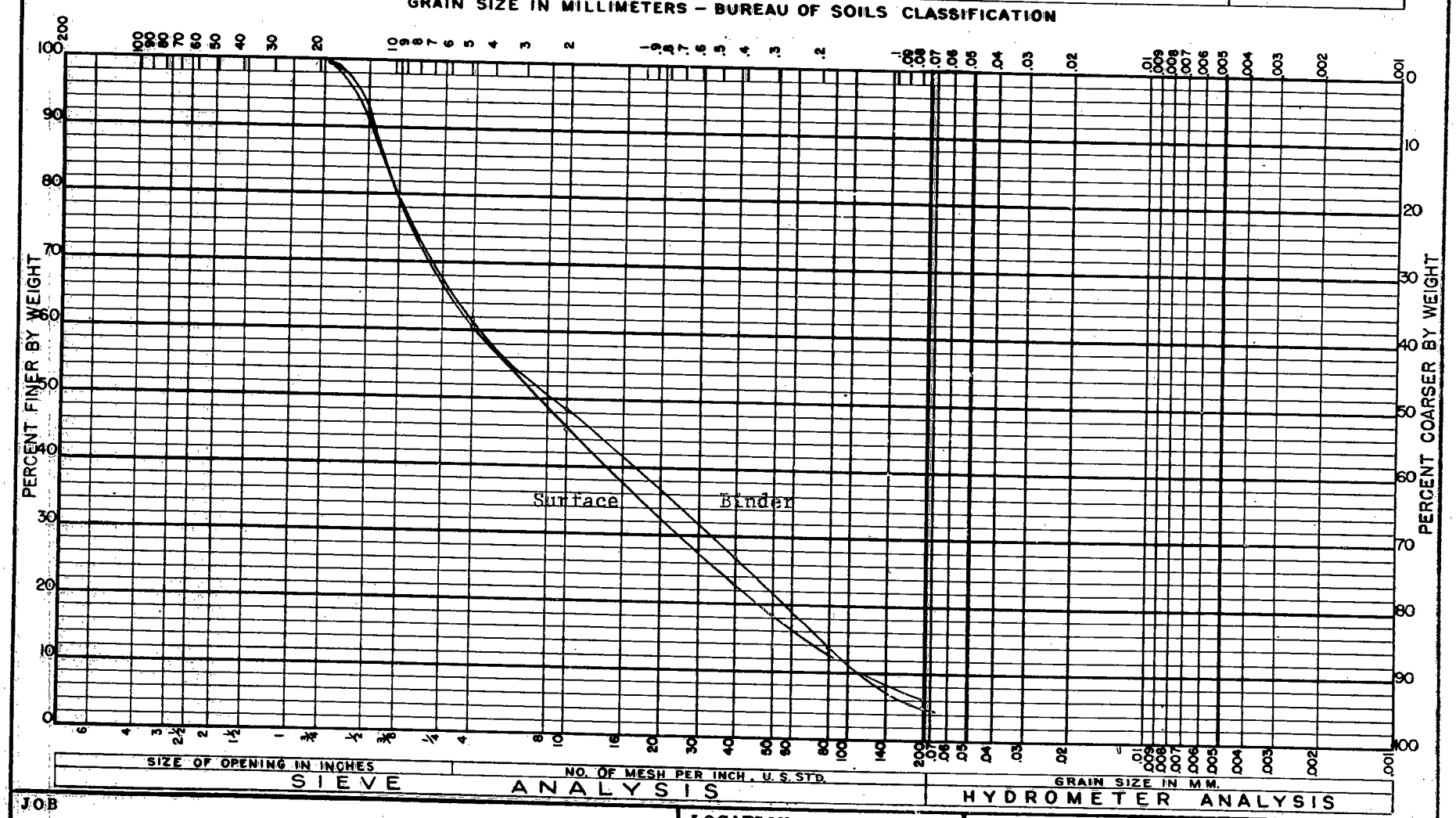
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 65+00 Surface & Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

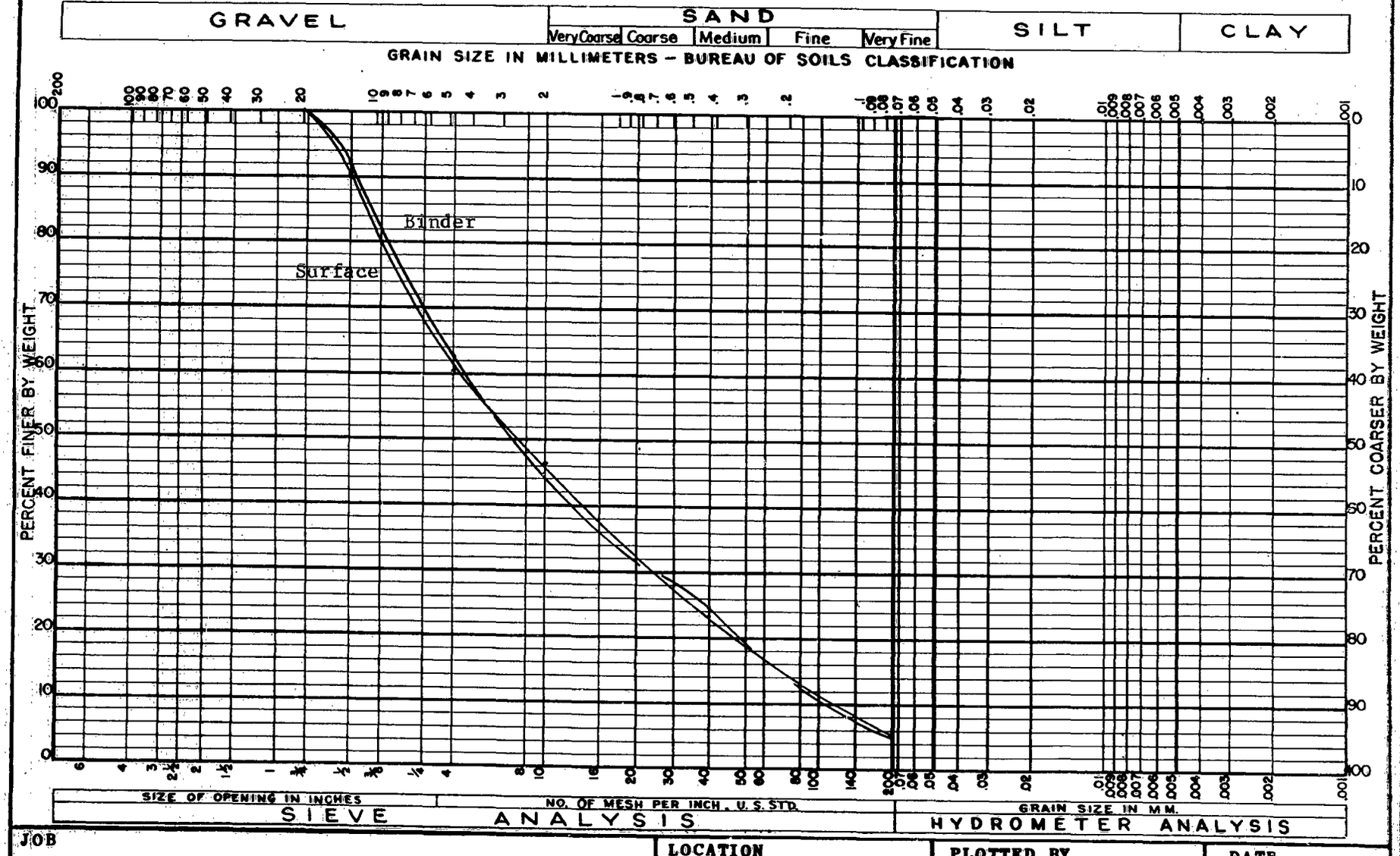
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 85+00 Surface & Binder	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

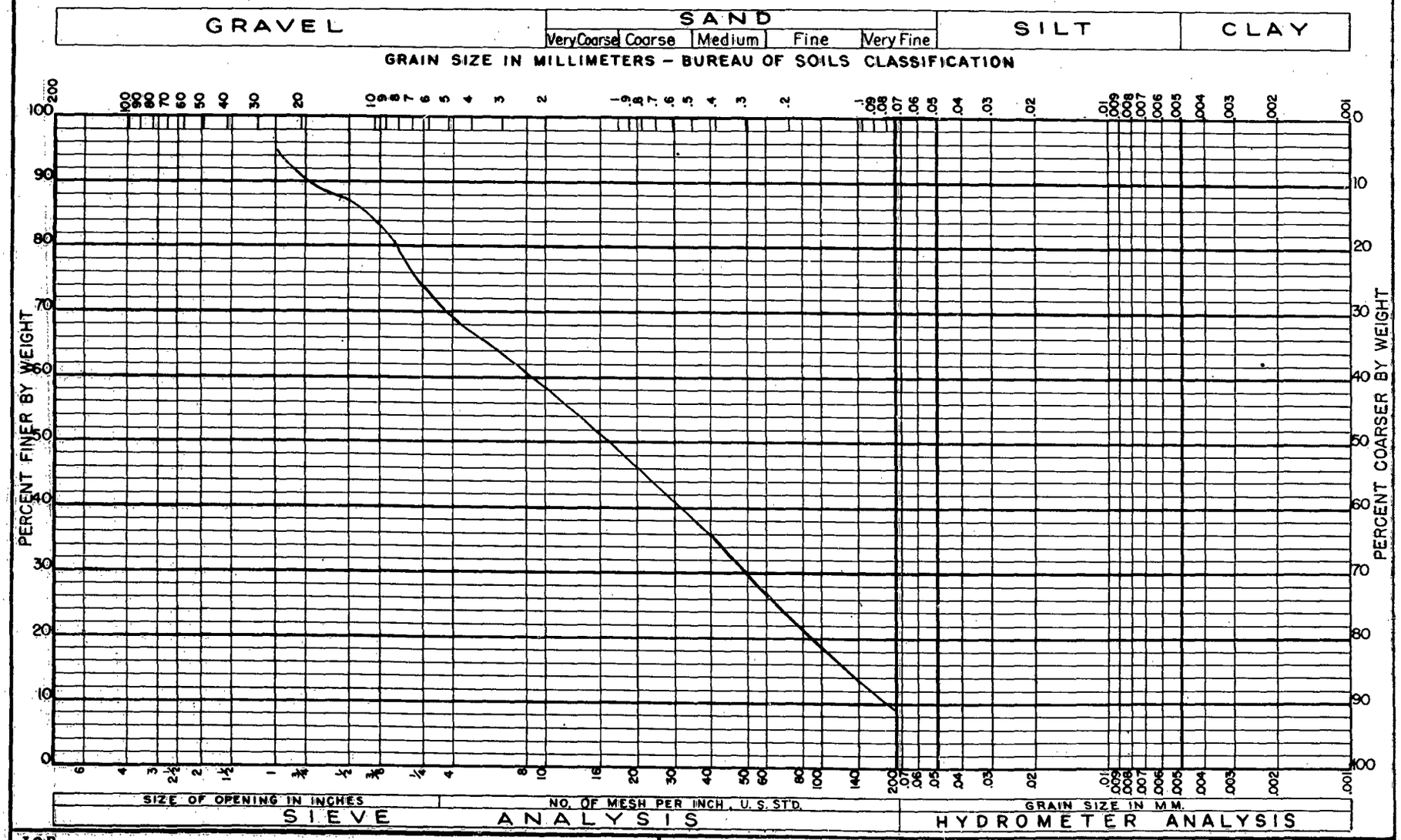
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 03R-21L - Station 93+50 Surface & Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

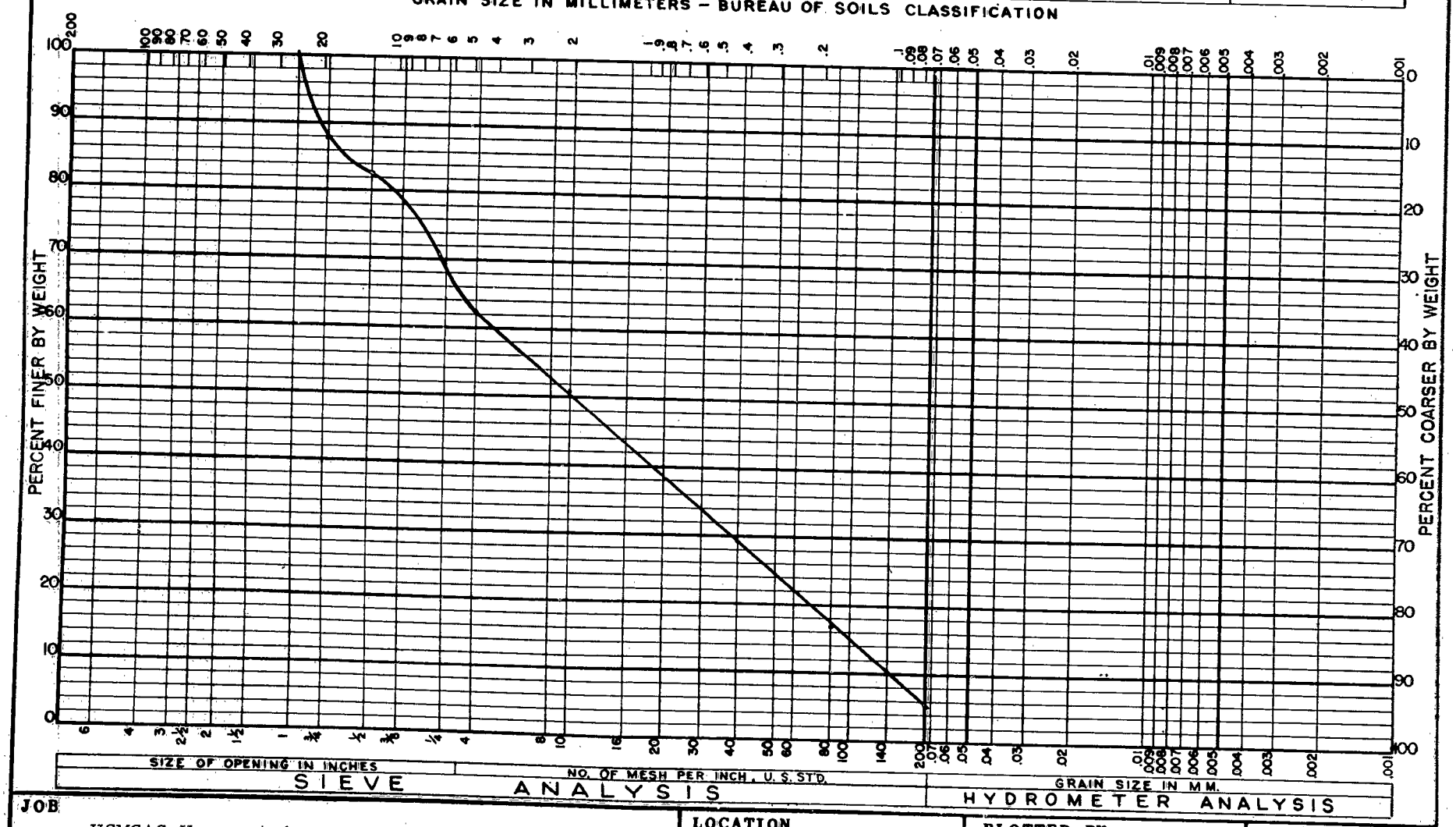
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 6+00	AC Pavement	KJD	June 1964

IND-NCEL-3960/4 (REV. 7-63)

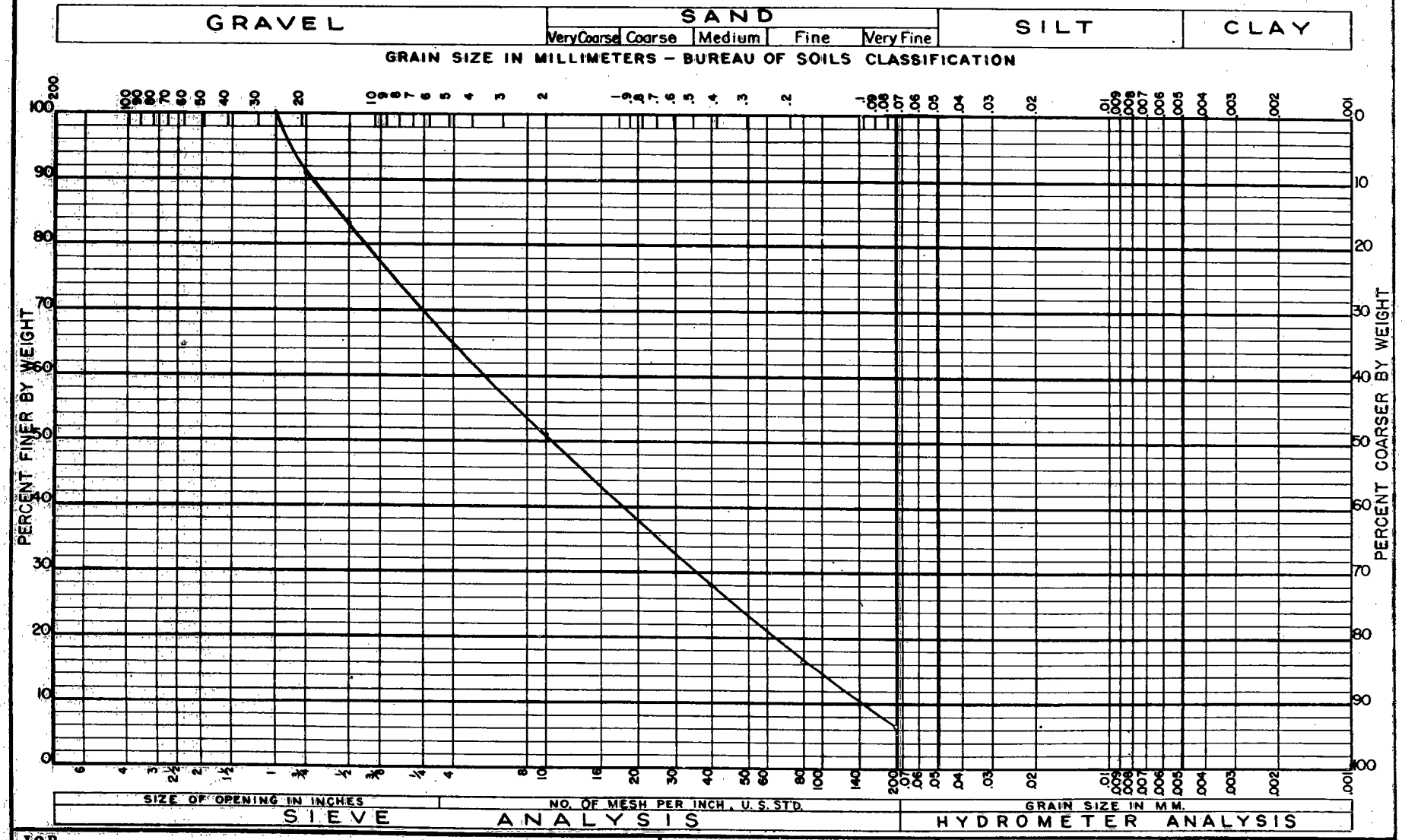
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 16+00	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

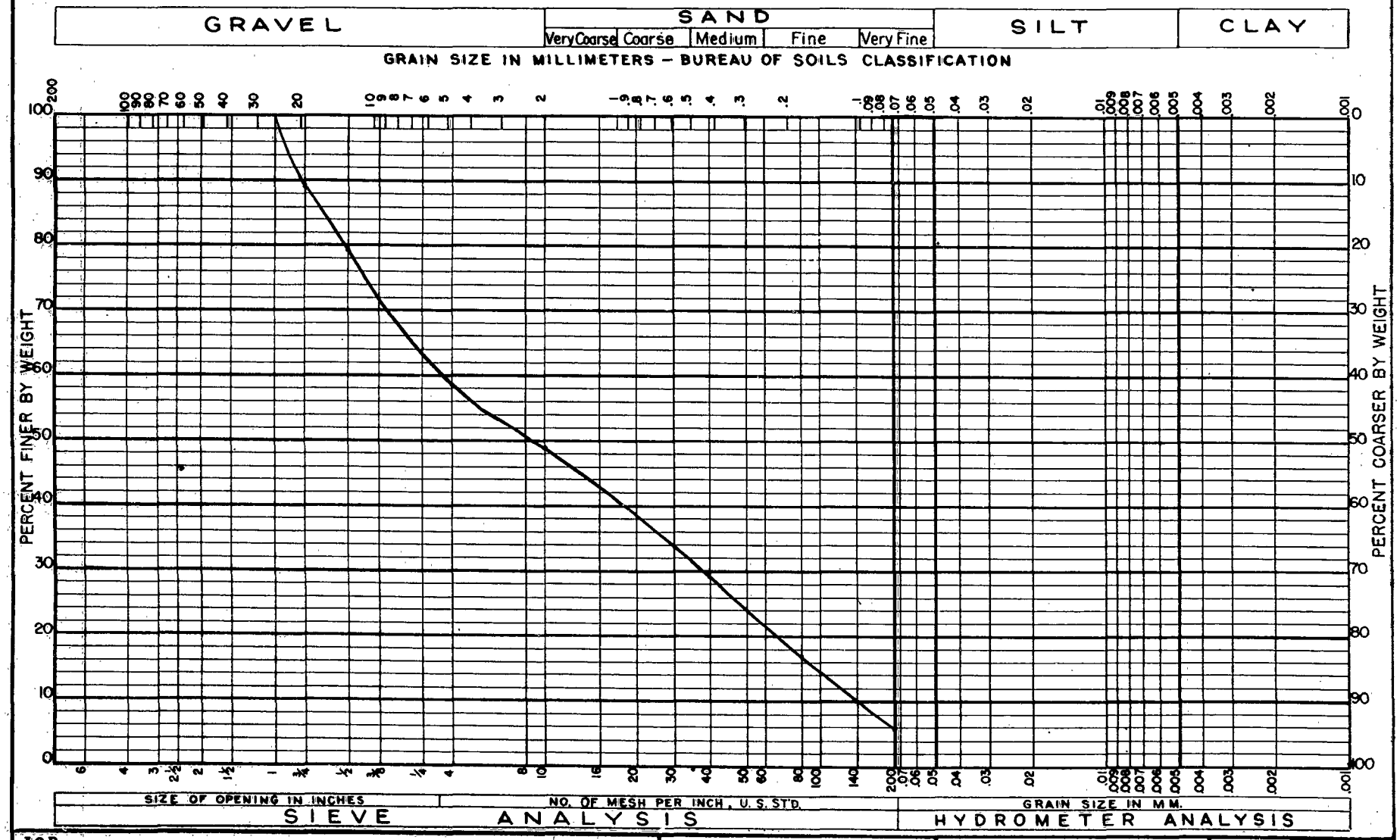
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 26+00	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

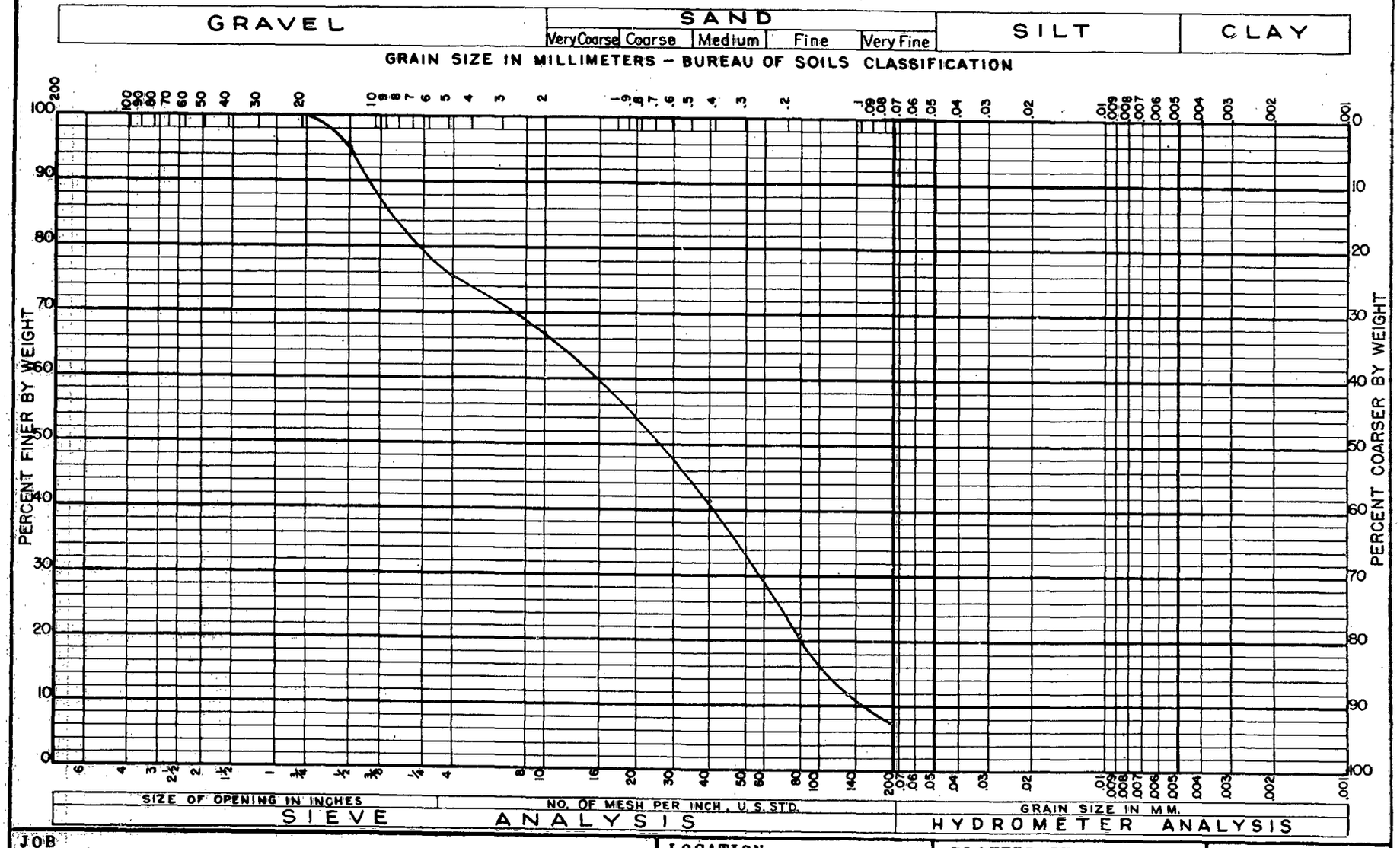
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 36+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

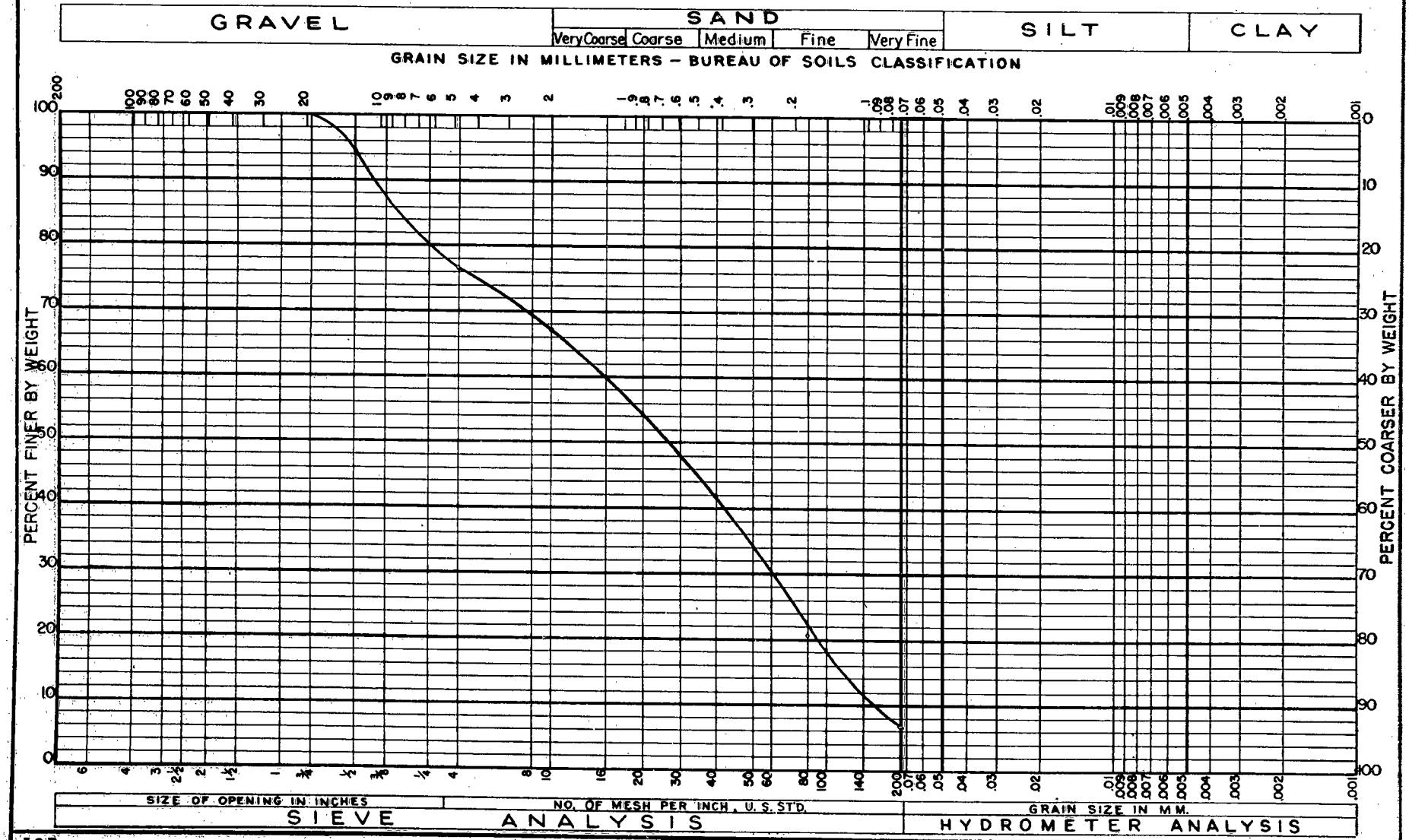
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 46+00	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

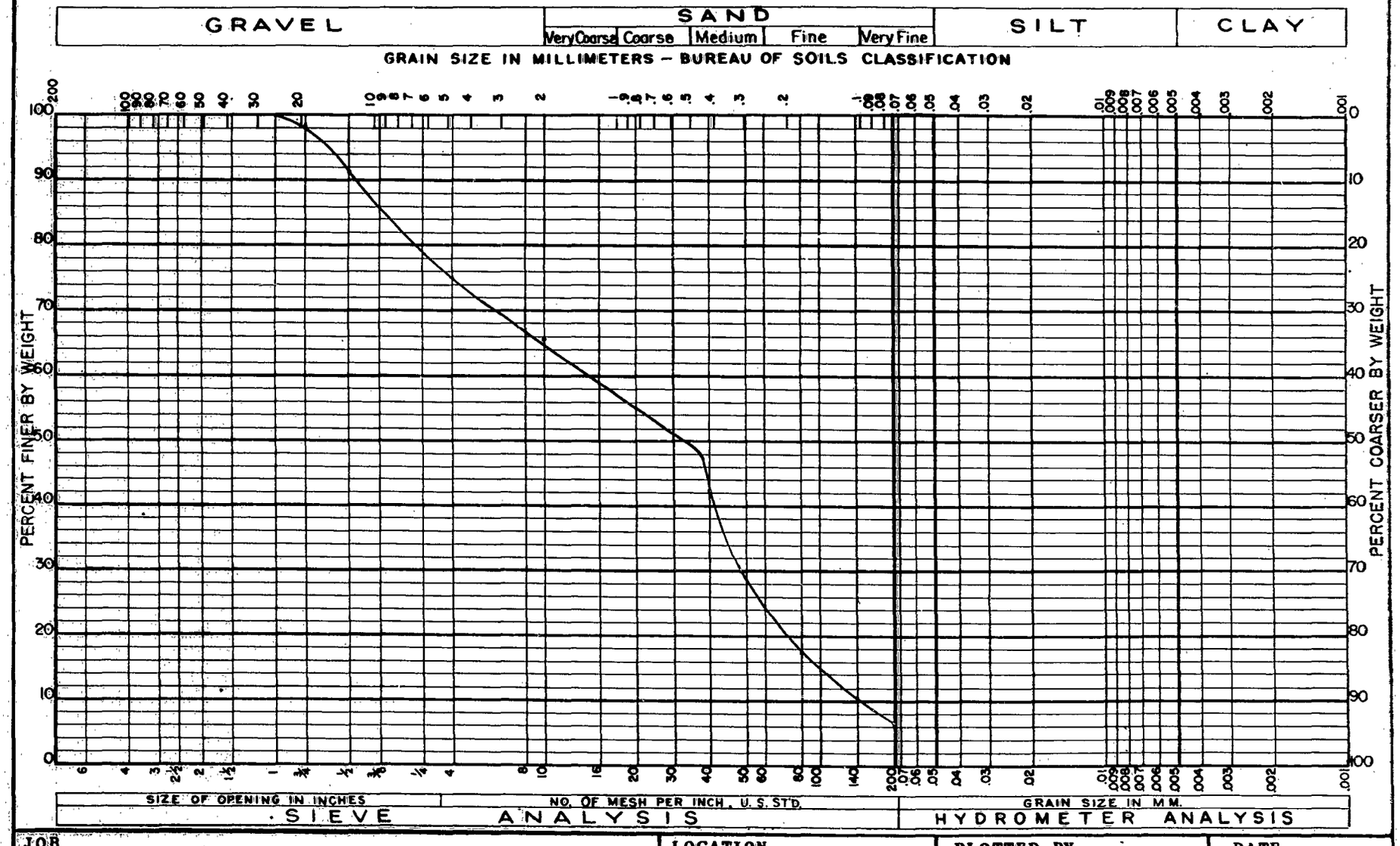
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 08-26 - Station 56+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

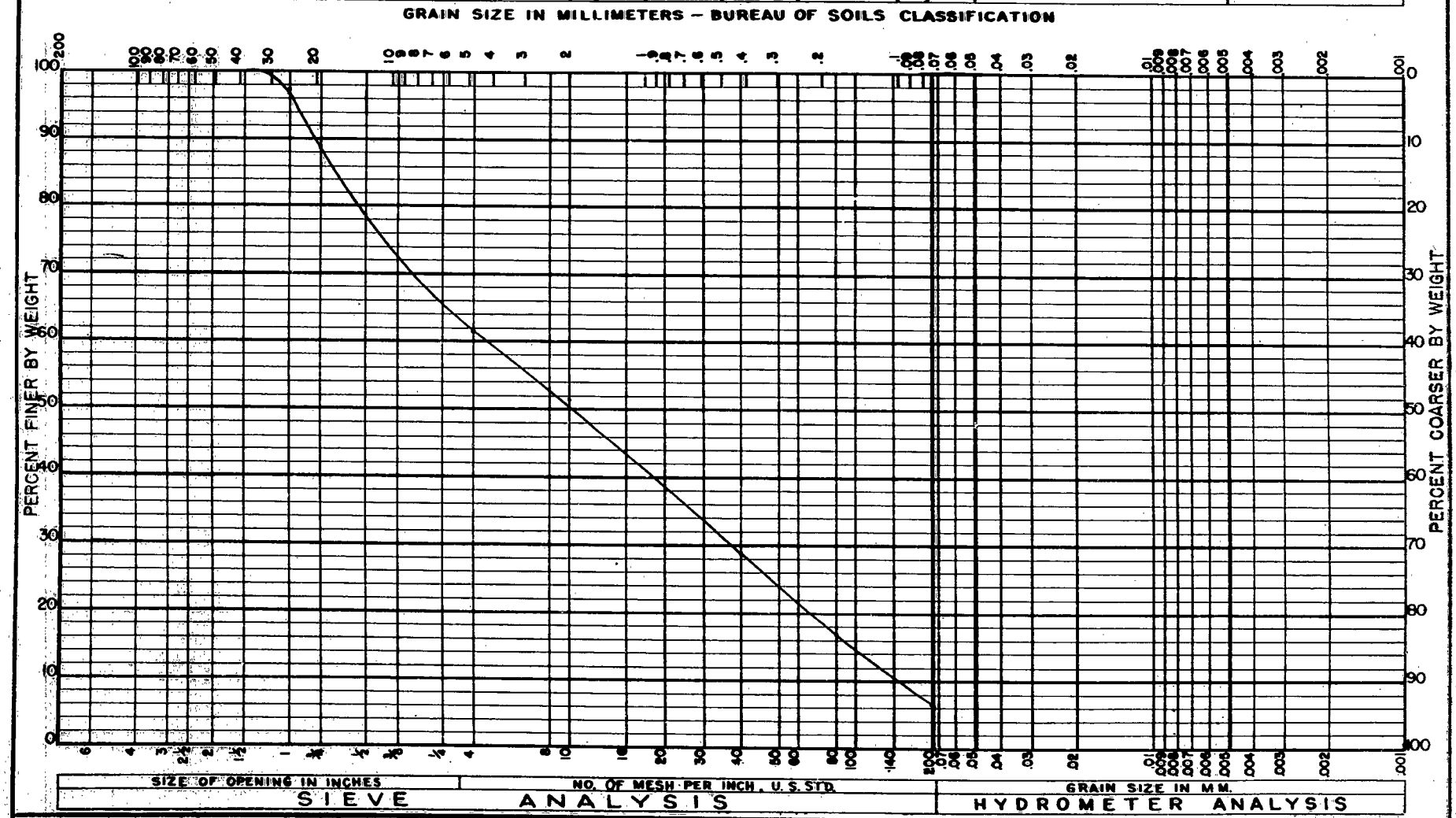
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 17-35 - Station 7+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

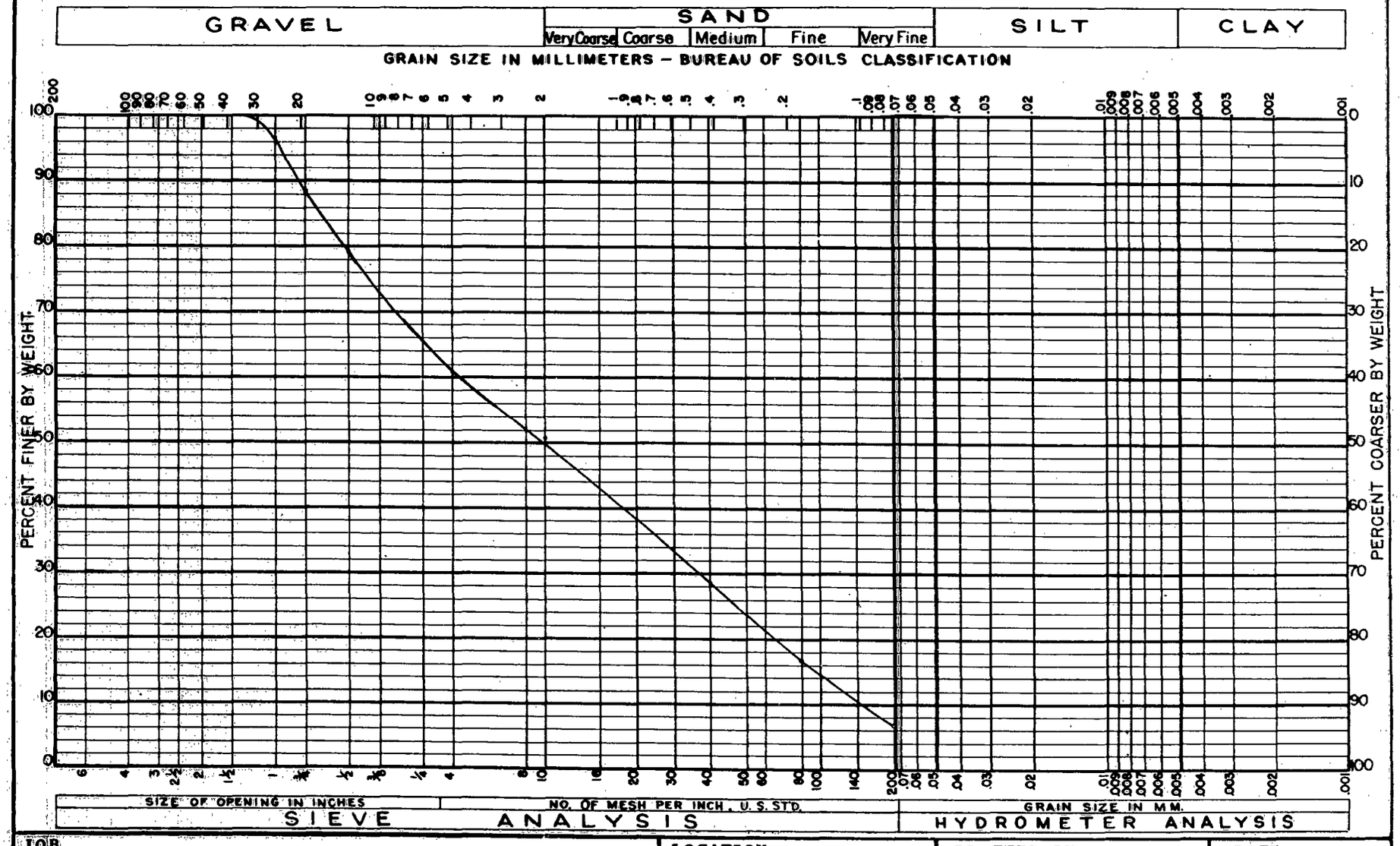
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 17-35 - Station 19+00	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

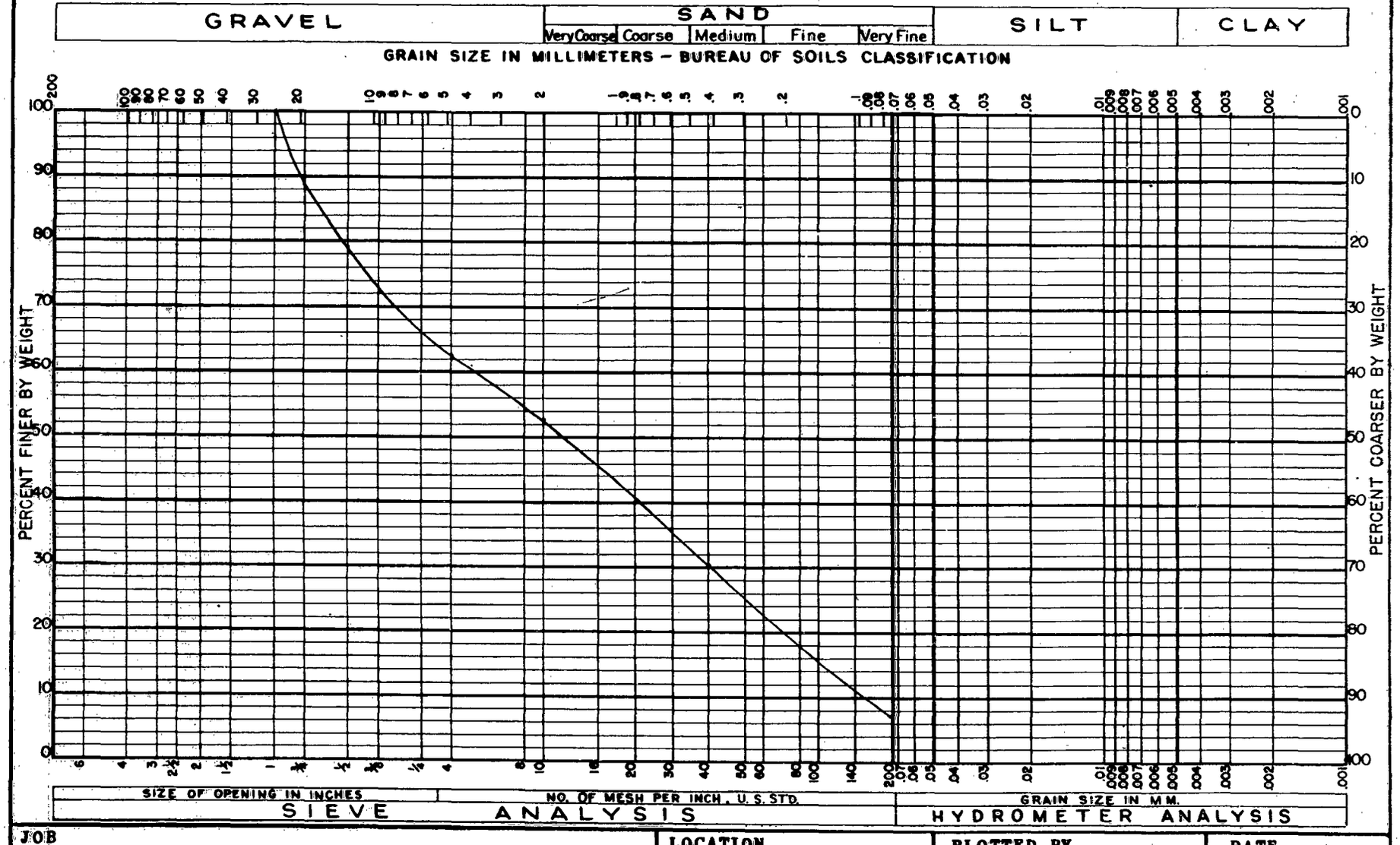
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 17-35 - Station 29+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

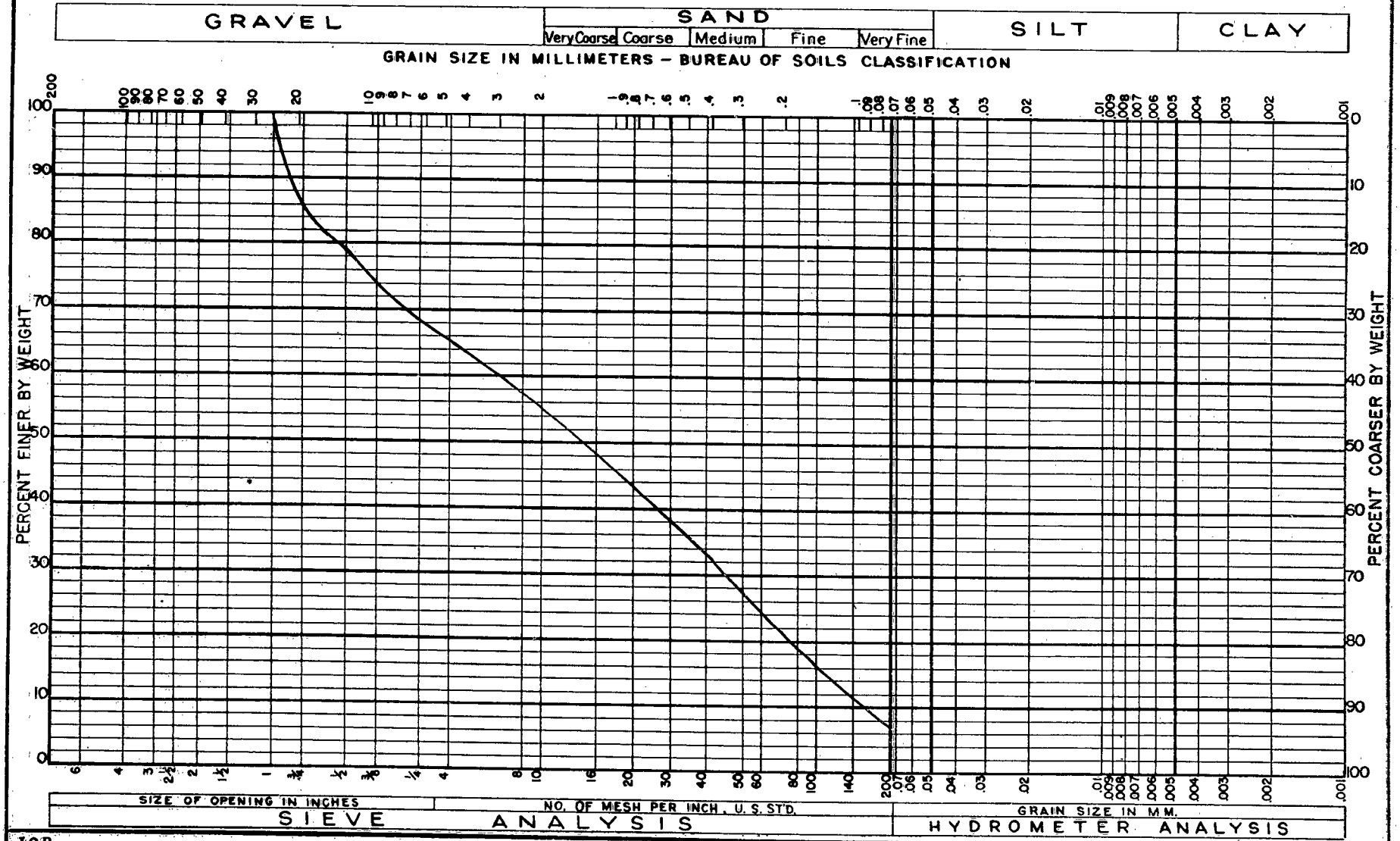
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 17-35 - Station 39+00	AC Pavement	RET	June 1964

1 IND-NCEL-3960/4 (REV. 7-63)

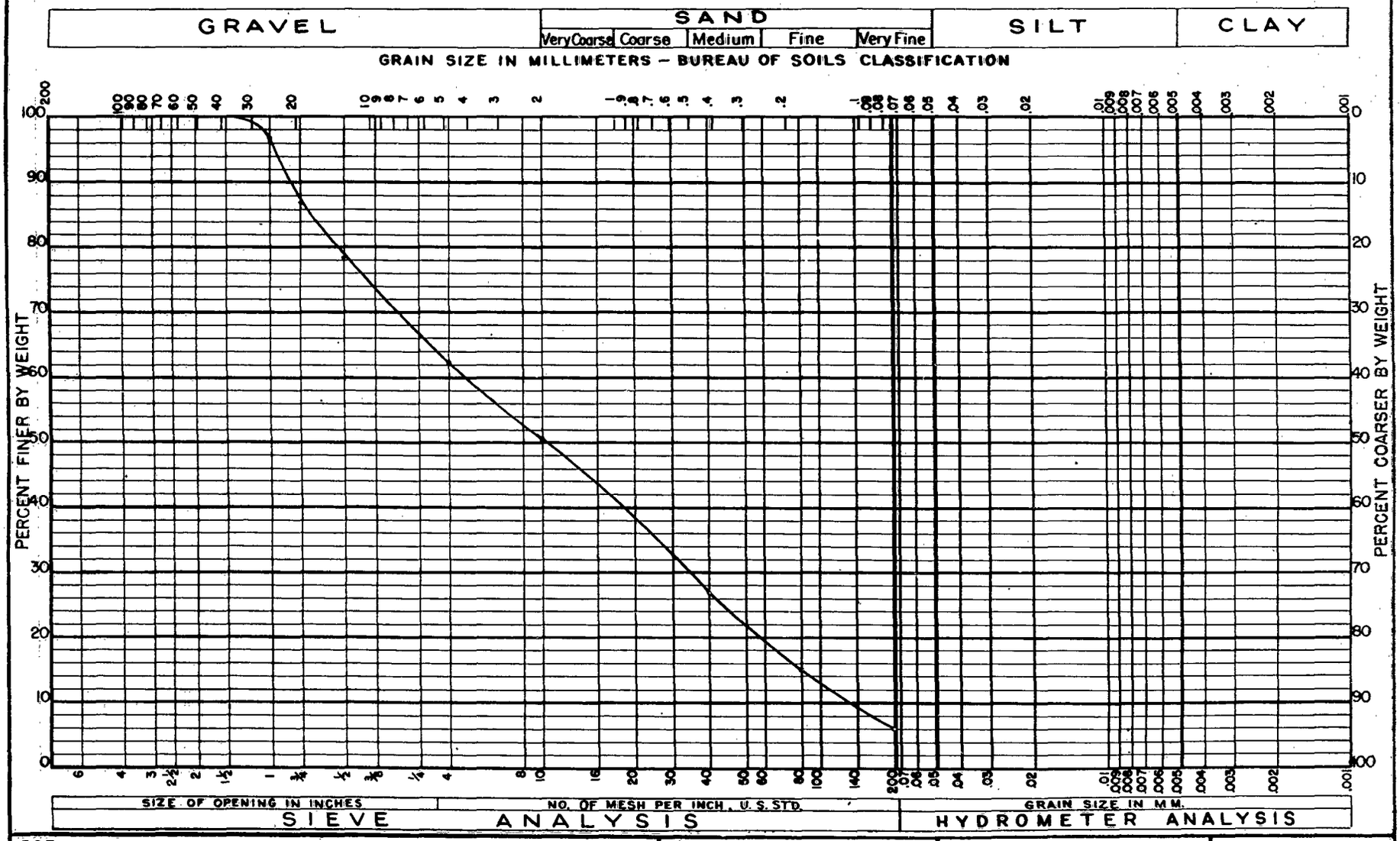
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Runway 17-35 - Station 49+00	AC Pavement	KJD	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

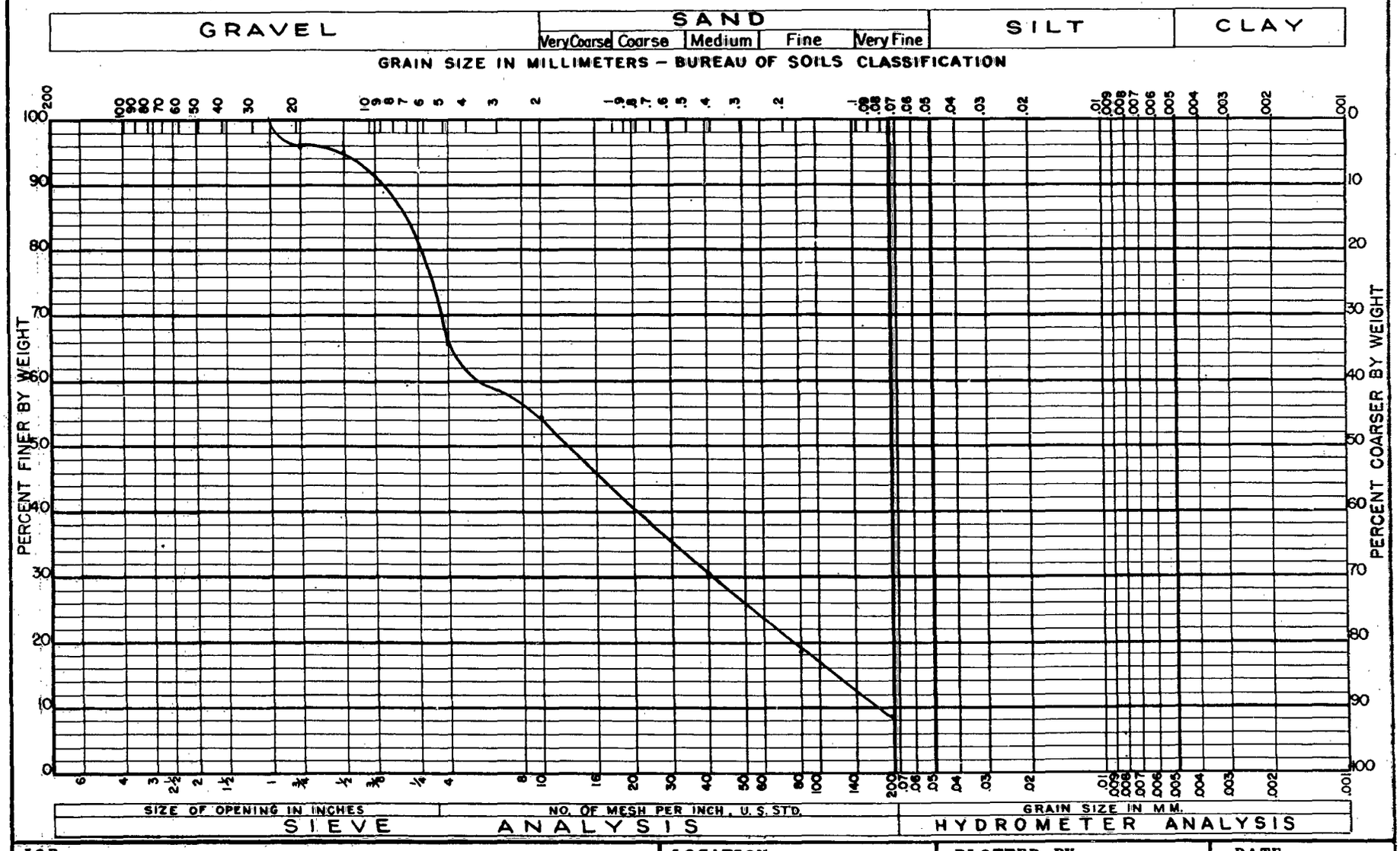
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1 - Station 12+00	AC Pavement	RET	June 64

IND-NCEL-3960/4 (REV. 7-63)

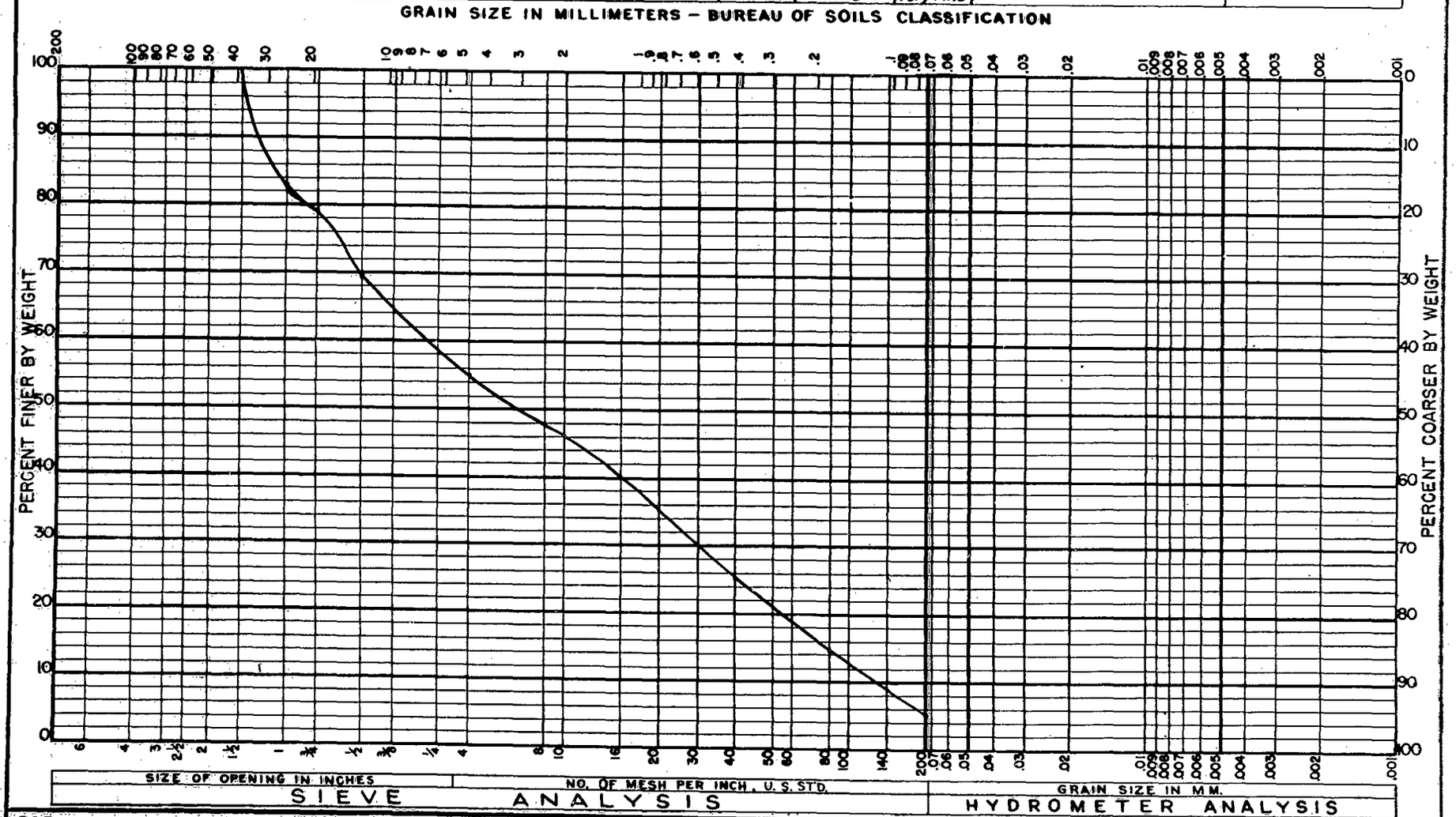
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1 - Station 22+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

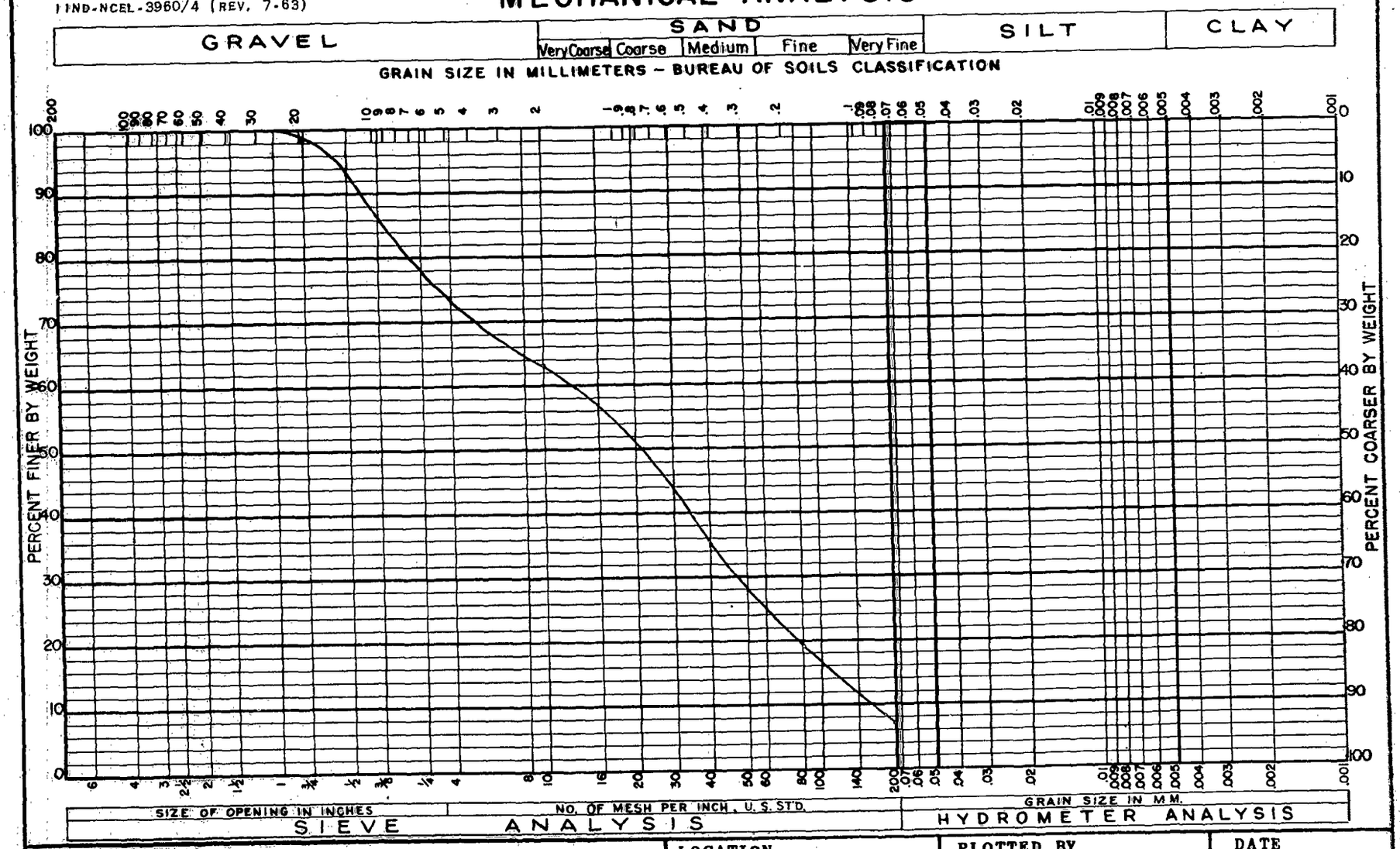
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1 - Station 32+00	AC Pavement	RET	June 1964

MECHANICAL ANALYSIS

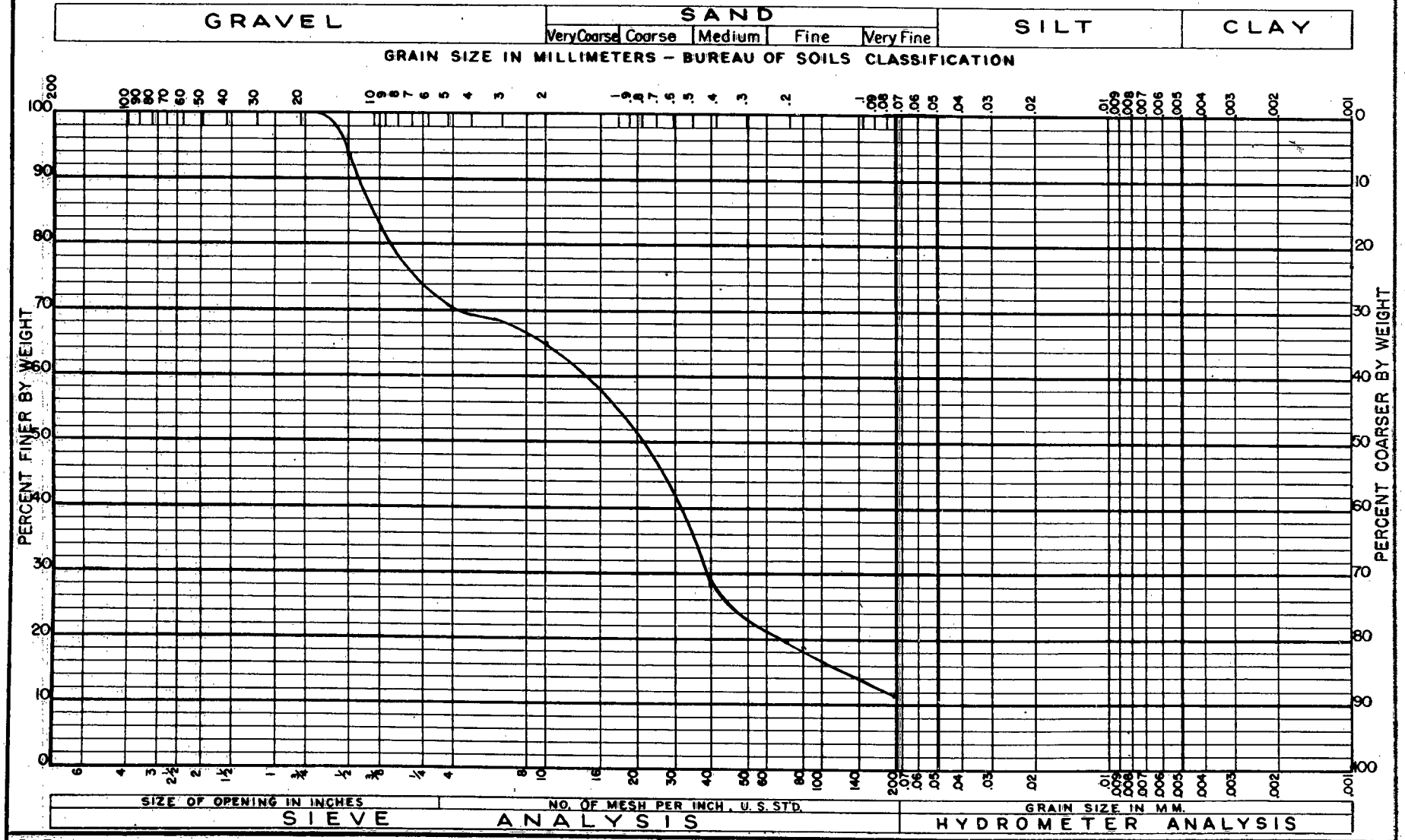
IND-NCEL-3960/4 (REV. 7-63)



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1 - Station 41+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

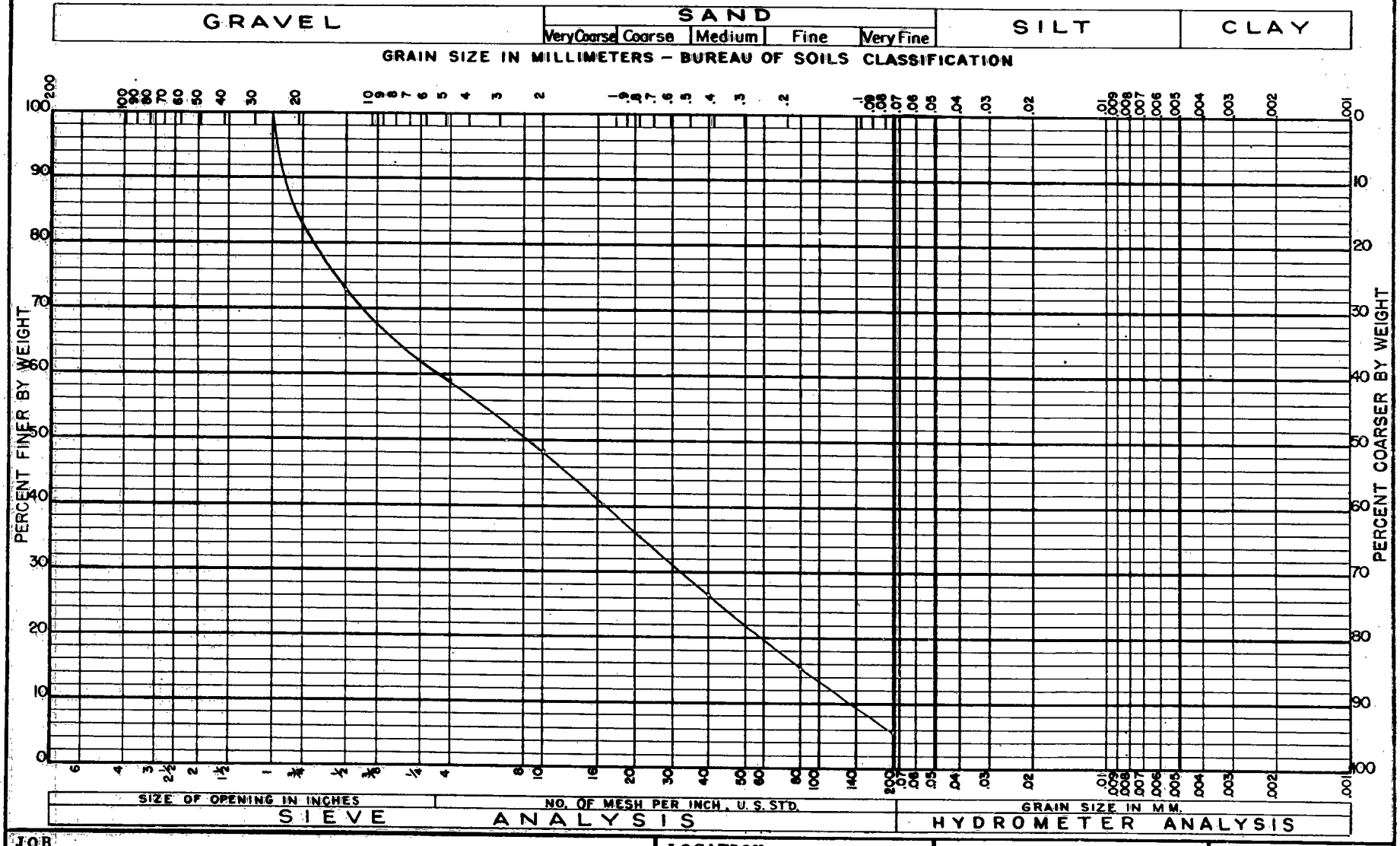
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1-A - Station 5+00	AC Pavement	RET	June 1964

1 IND-NCEL-3960/4 (REV. 7-63)

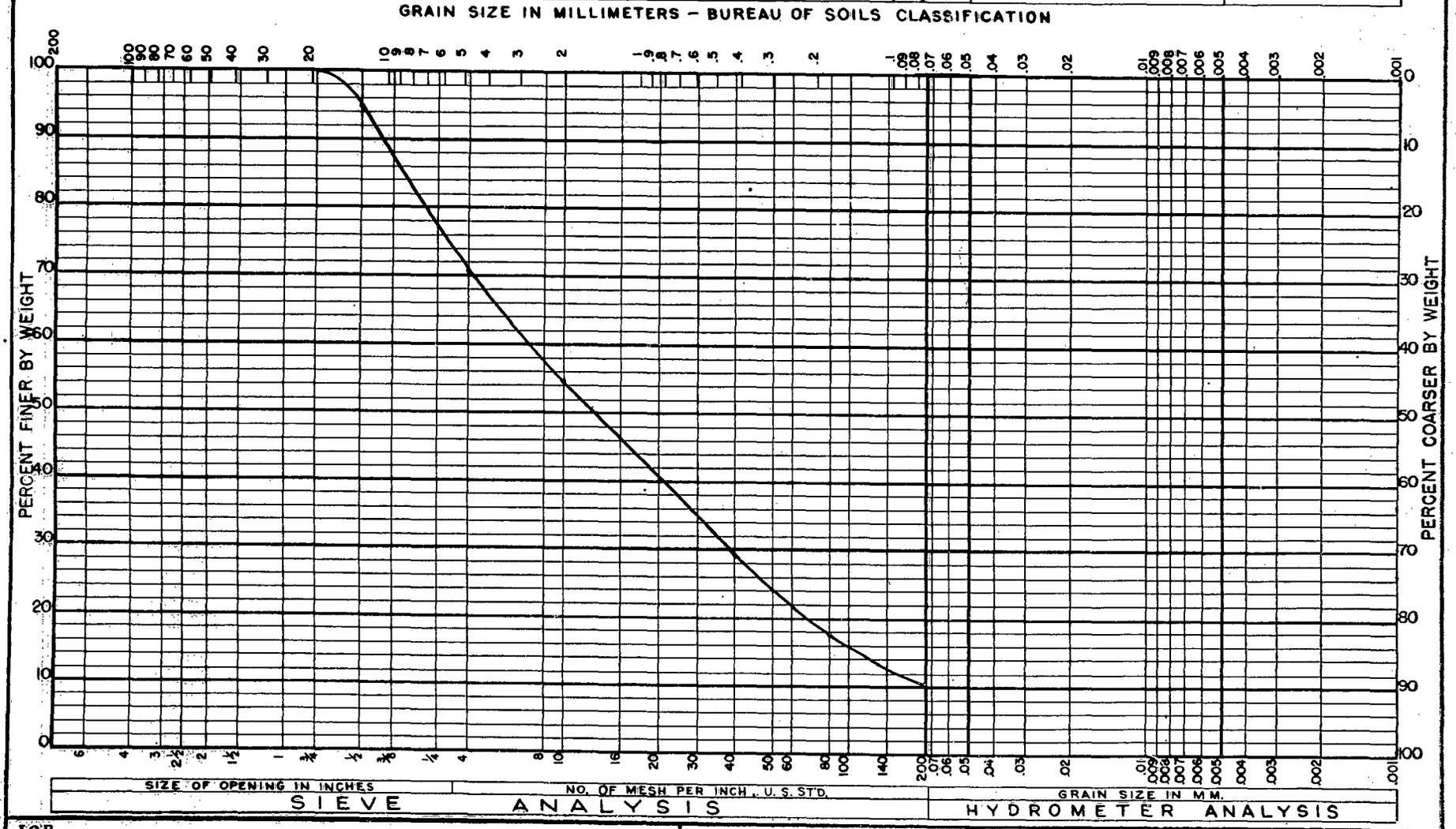
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 1-B - Station 2+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

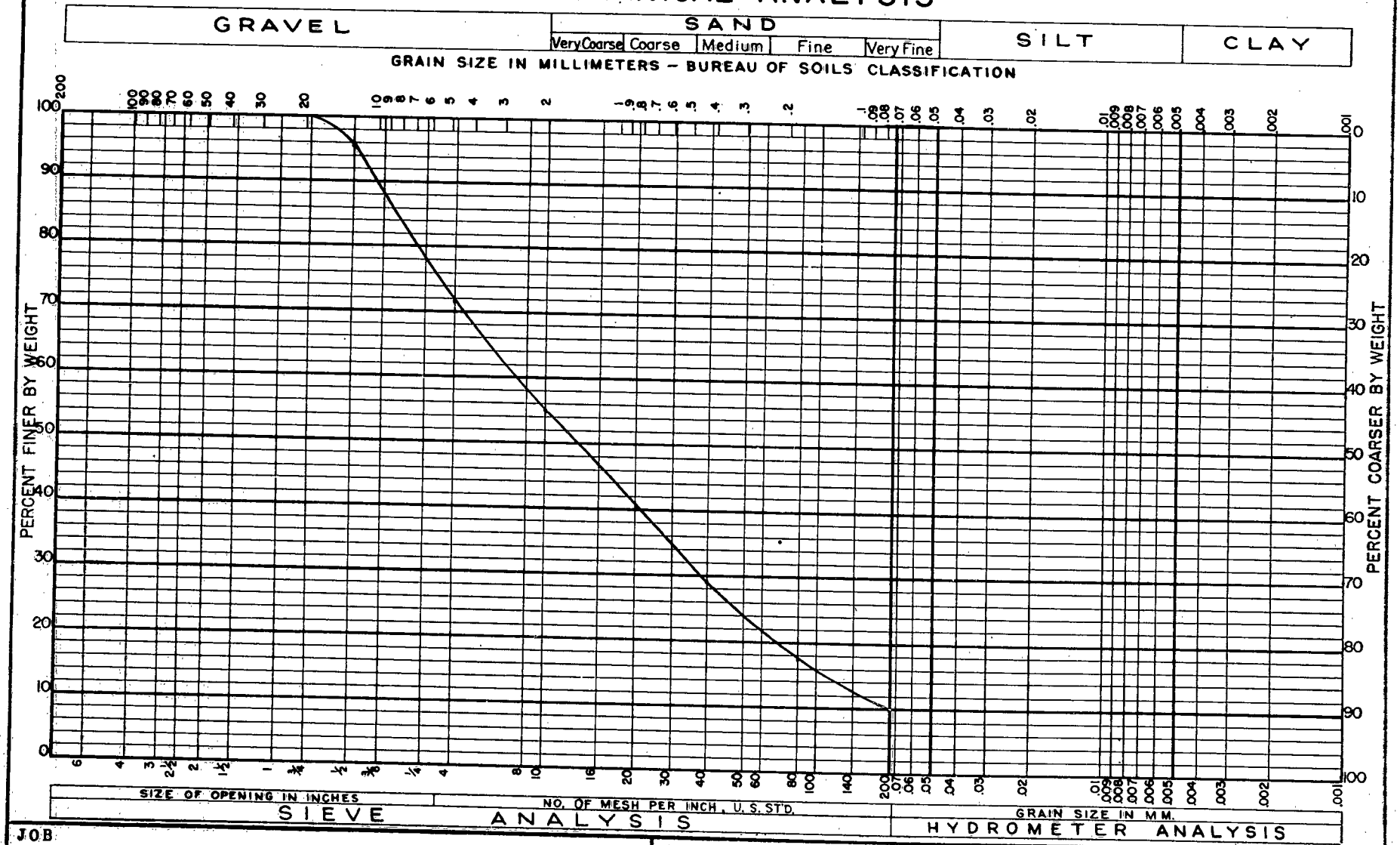
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 2 - Station 2+00	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

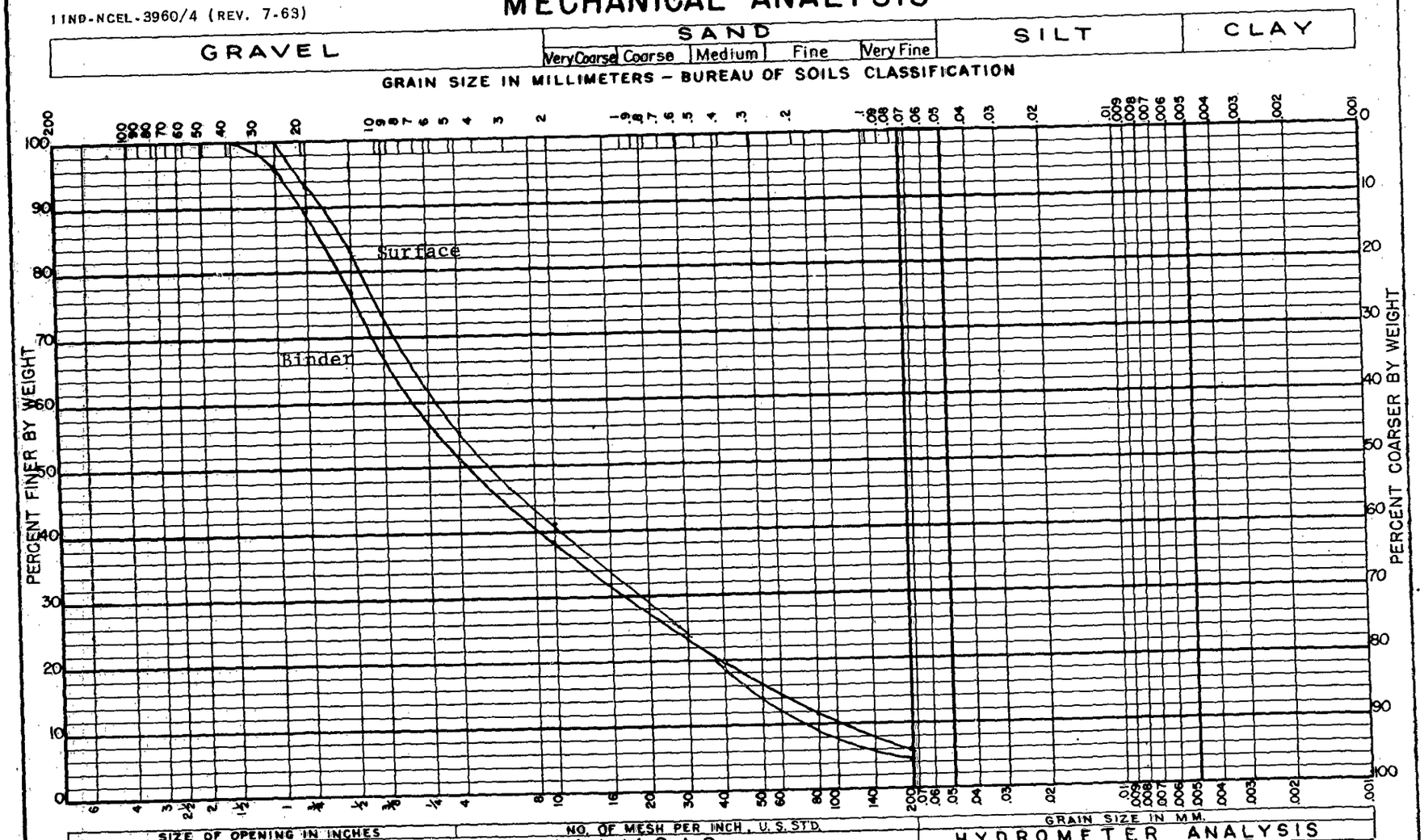
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 2 - Station 9+00	AC Pavement	RET	June 1964

MECHANICAL ANALYSIS

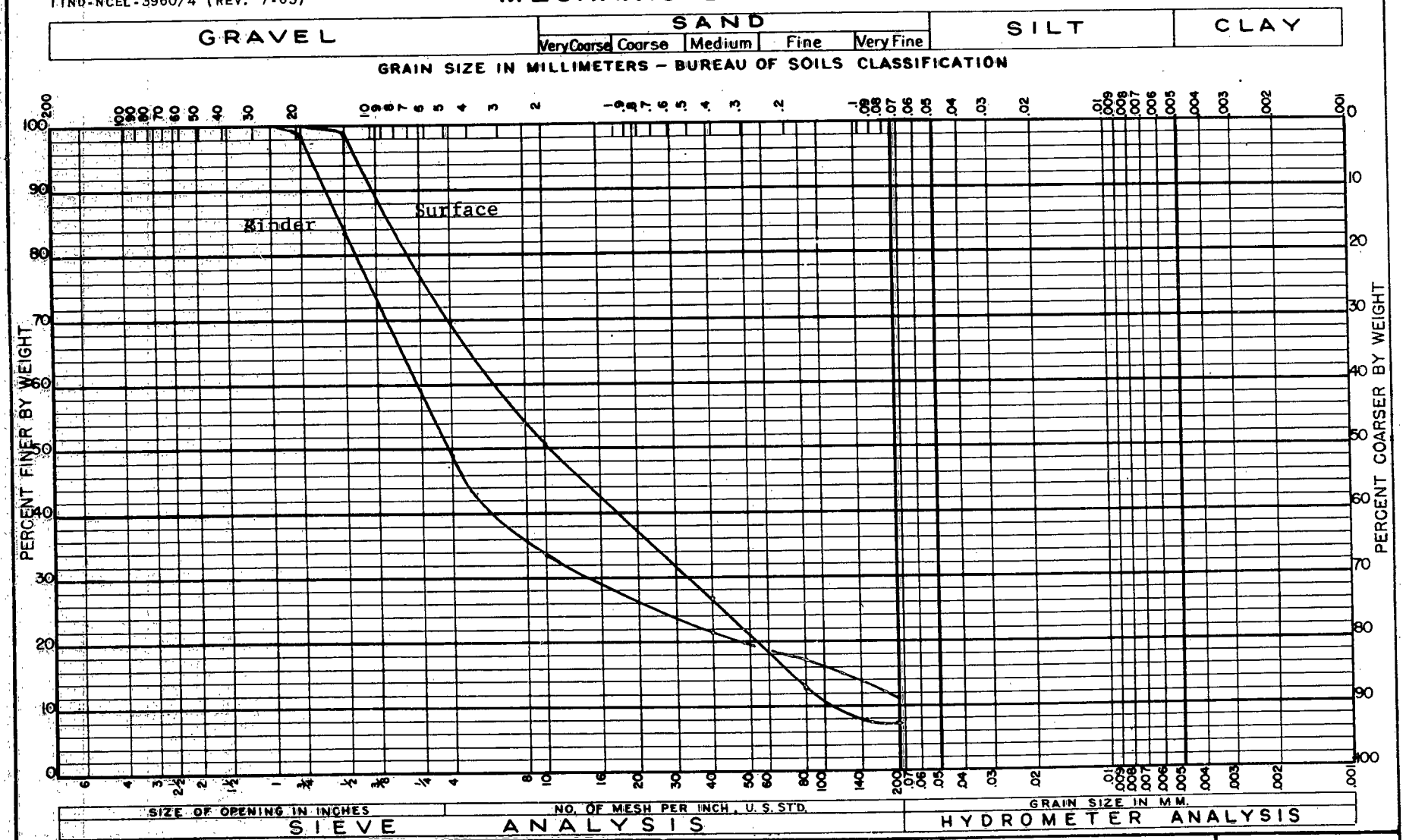
1 IND-NCEL-3960/4 (REV. 7-63)



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona - Taxiway 6 Station 1+50 Offset :- Surface and Binder	AC Pavement	RET	June 1964

MECHANICAL ANALYSIS

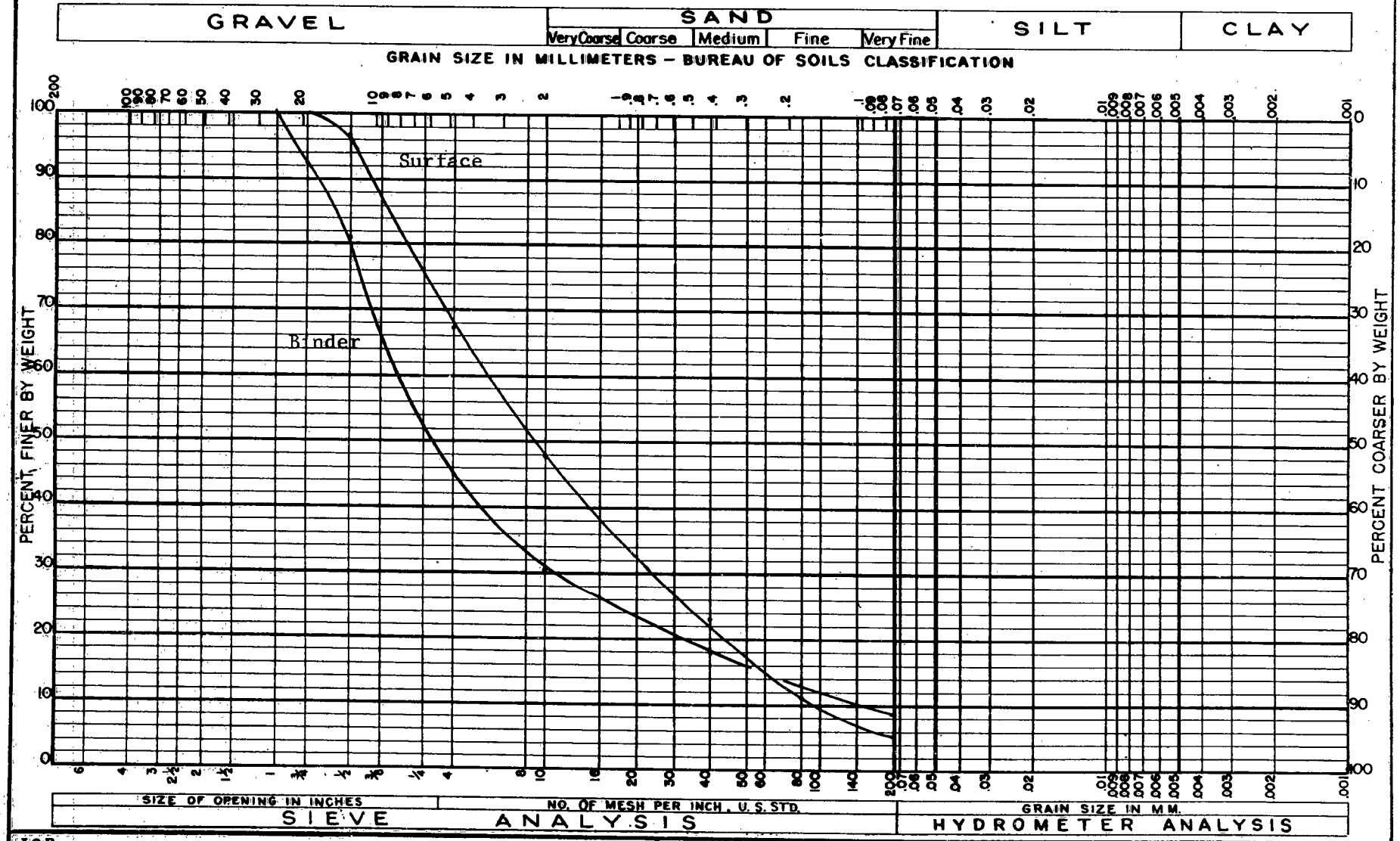
IND-NCEL-3960/4 (REV. 7-63)



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 6 - Station 6+00 Surface and Binder	AC Pavement	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

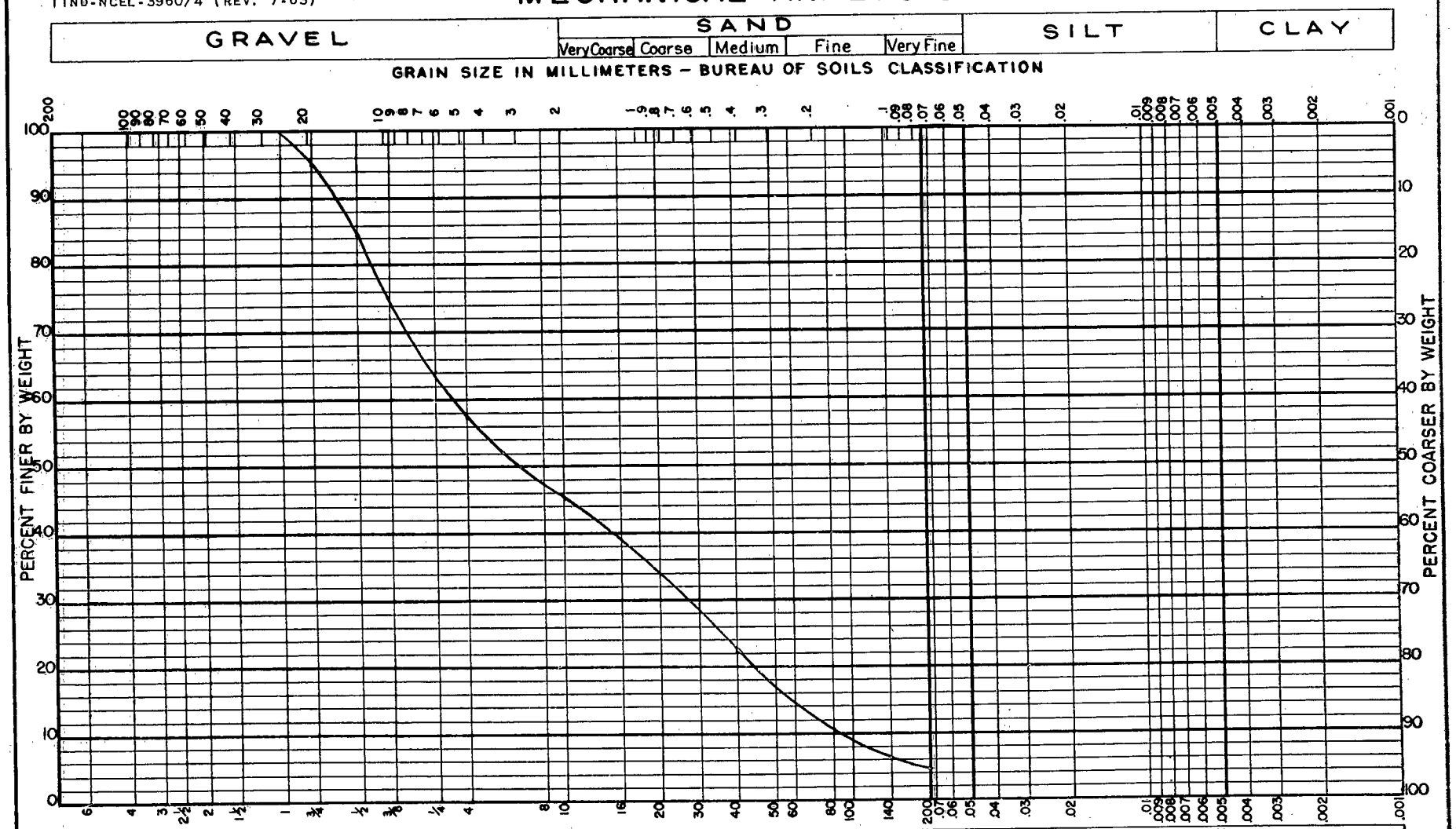
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 6 - Station 14+00 Surface and Binder	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

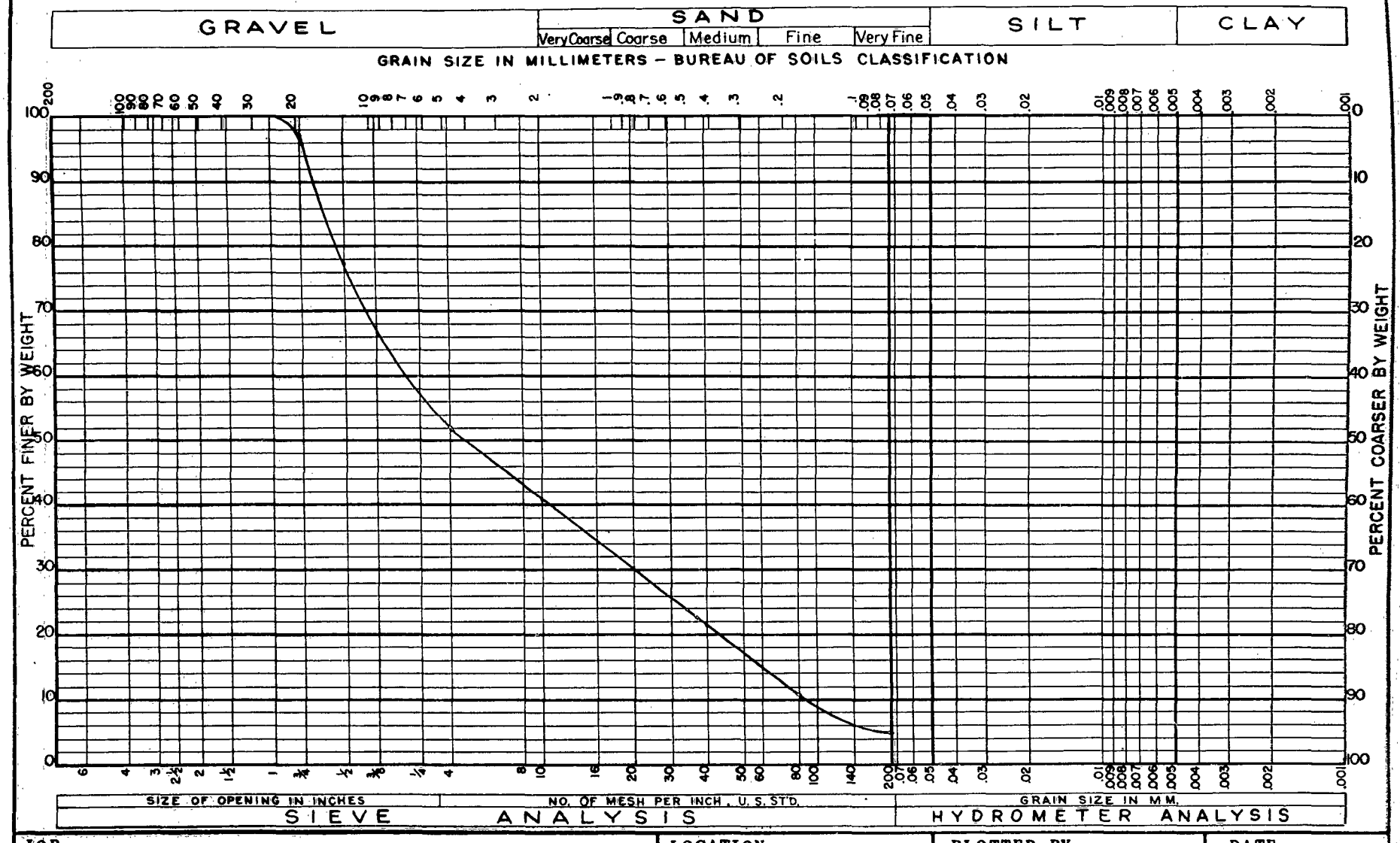
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 6-A - Station 6+00	AC Pavement	RET	June 1964

IIND-NCEL-3960/4 (REV. 7-63)

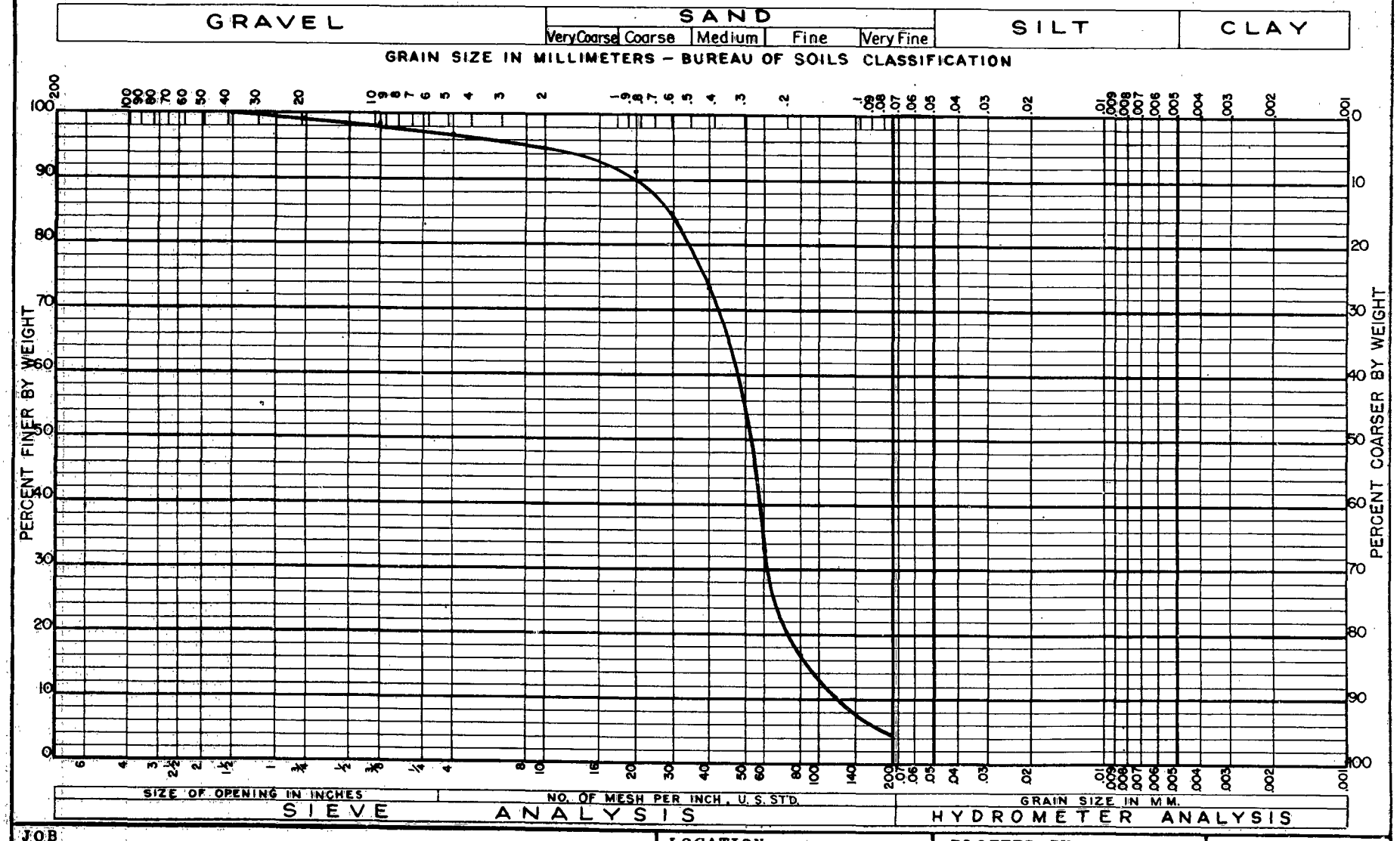
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
USMCAS Yuma, Arizona Taxiway 6-A - Station 16+00	AC Pavement	RET	June 1964

I.IND-NCEL-3960/4 (REV. 7-63)

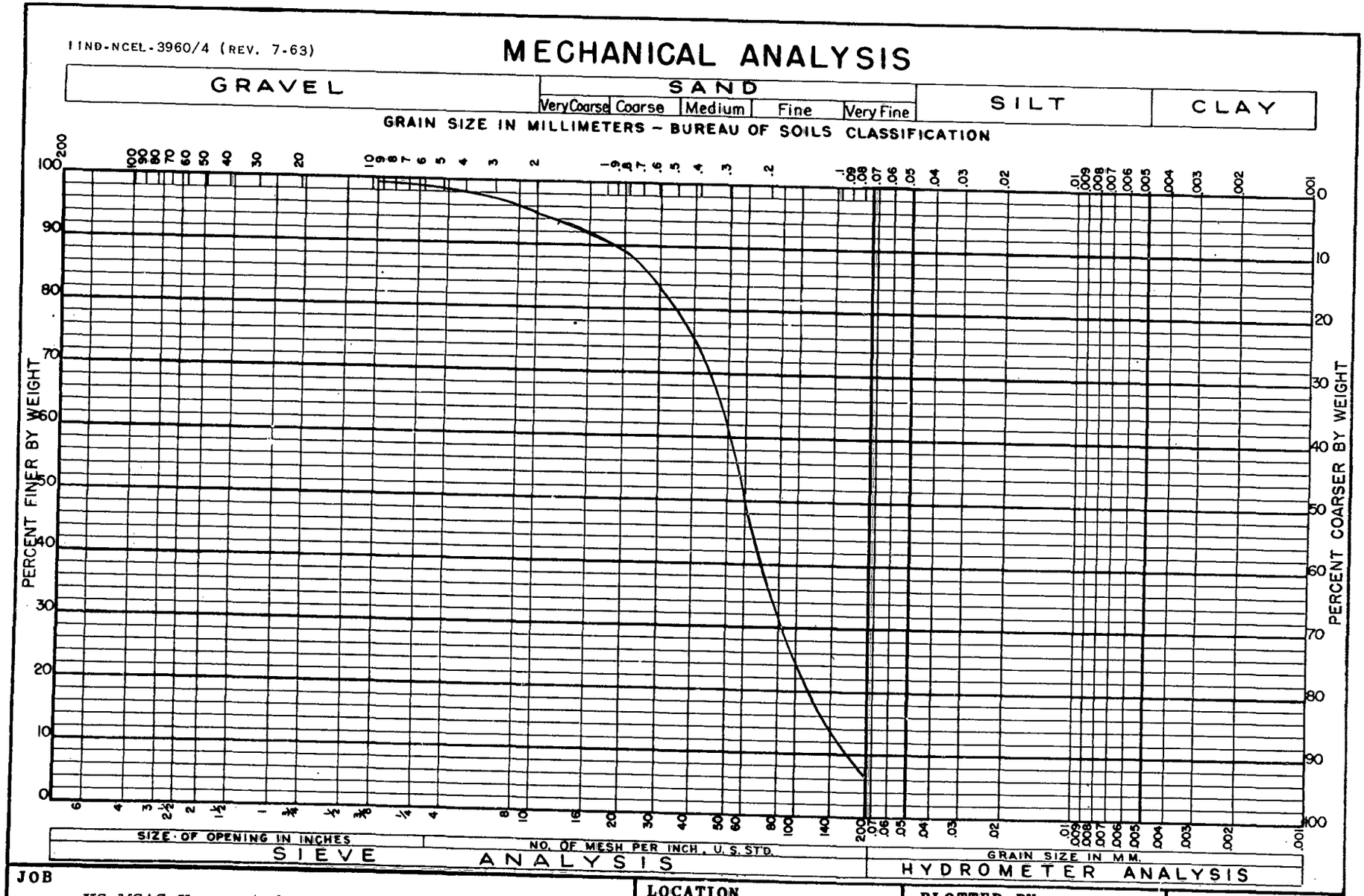
MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Operations Parking Apron - PA-1	Base	RET	June 1964

IND-NCEL-3960/4 (REV. 7-63)

MECHANICAL ANALYSIS



JOB	LOCATION	PLOTTED BY	DATE
US MCAS Yuma, Arizona Operations Parking Apron - PA-2	10 inches below top A.C.	KJD	June 1964

Appendix G

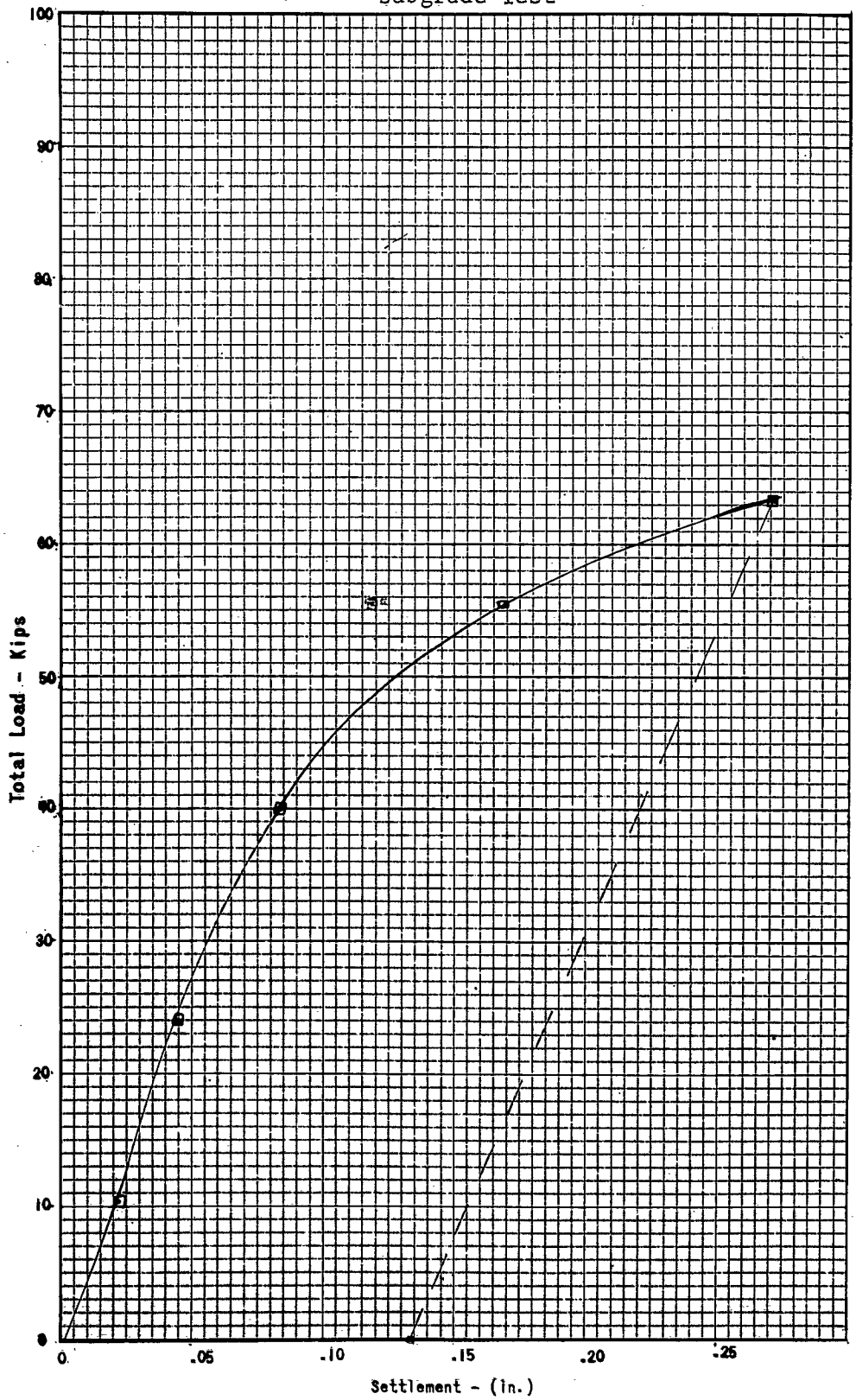
SUBGRADE PLATE LOAD TEST RESULTS

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	12+00

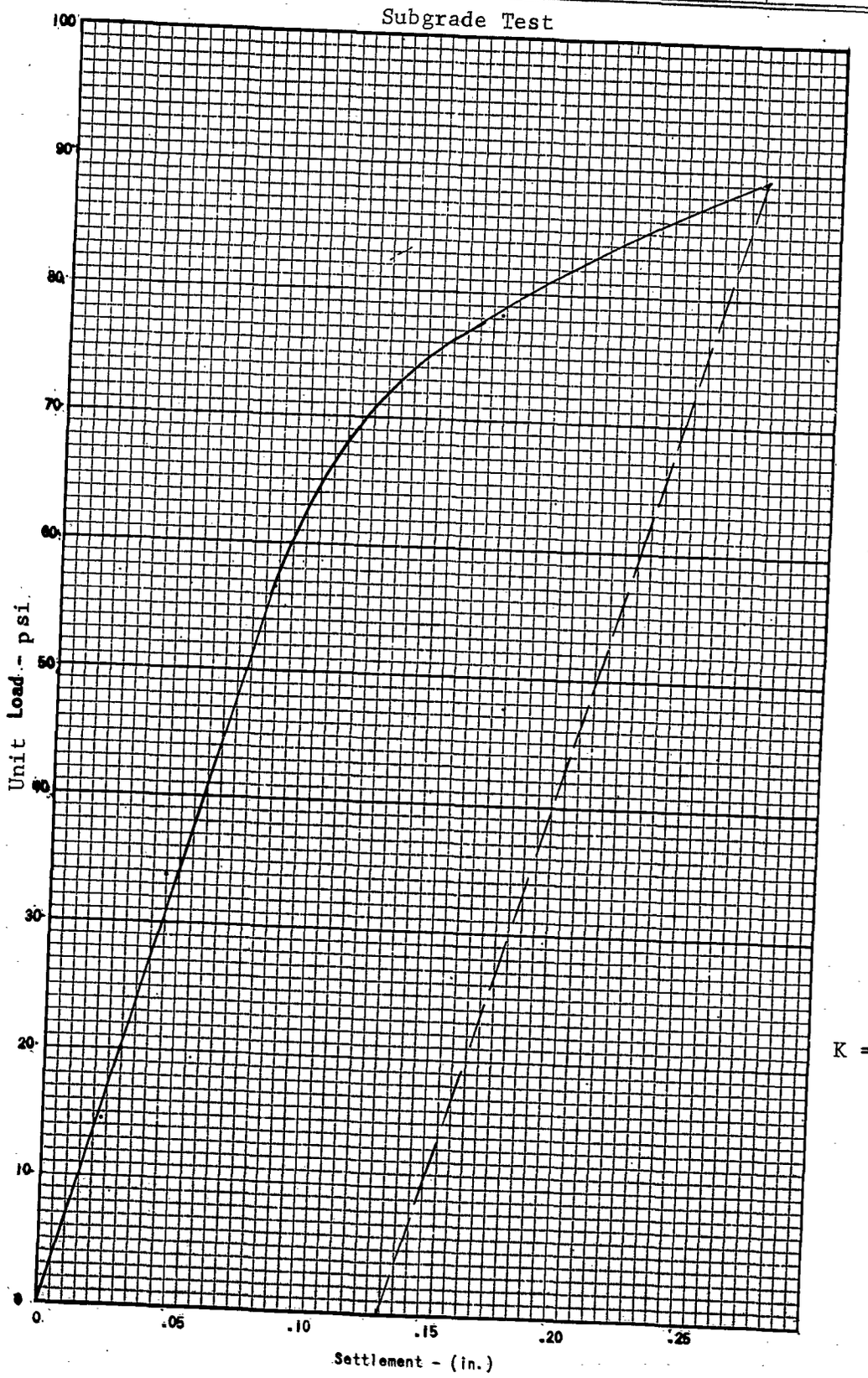
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	12+00

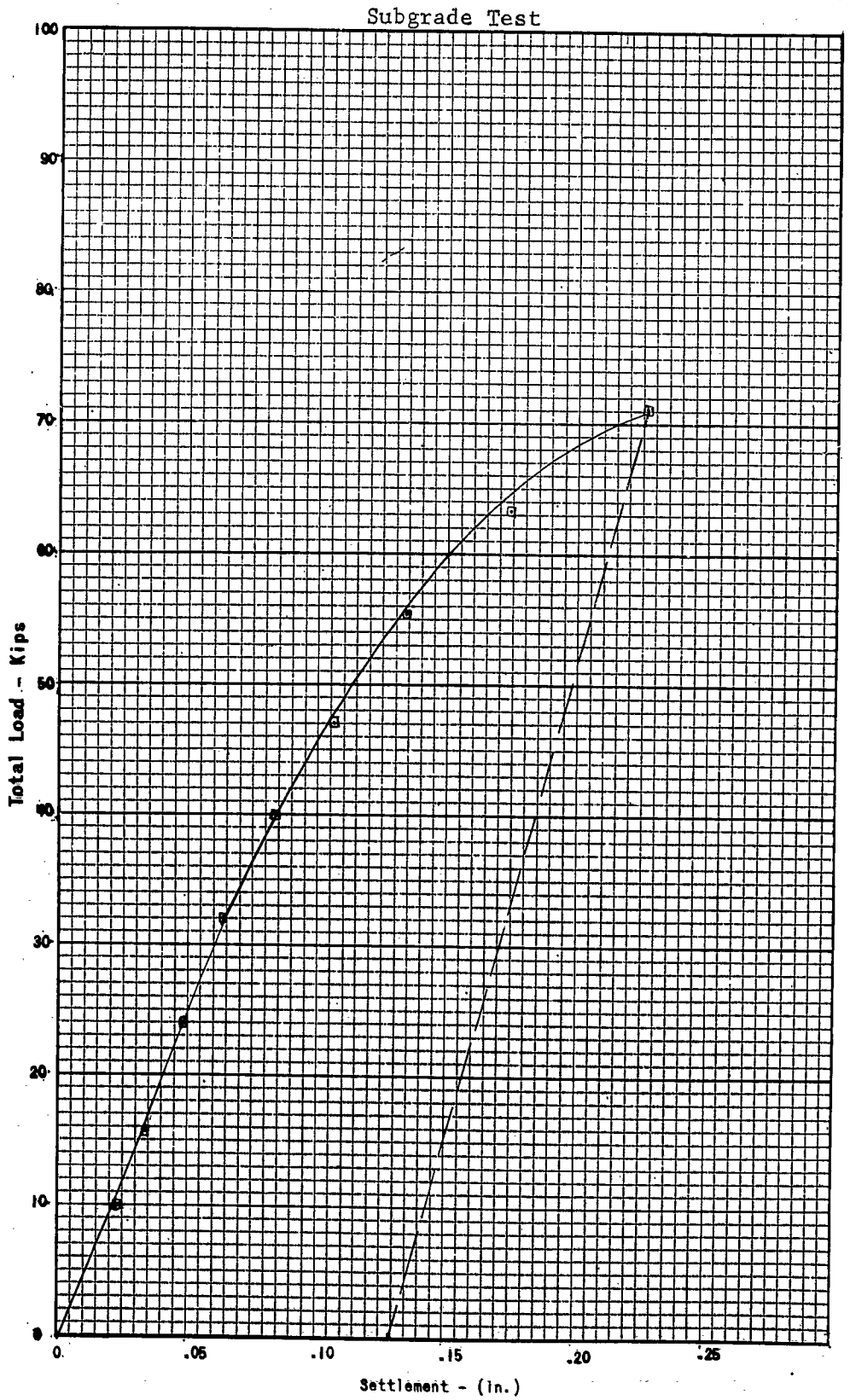


K = 680 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	22+00

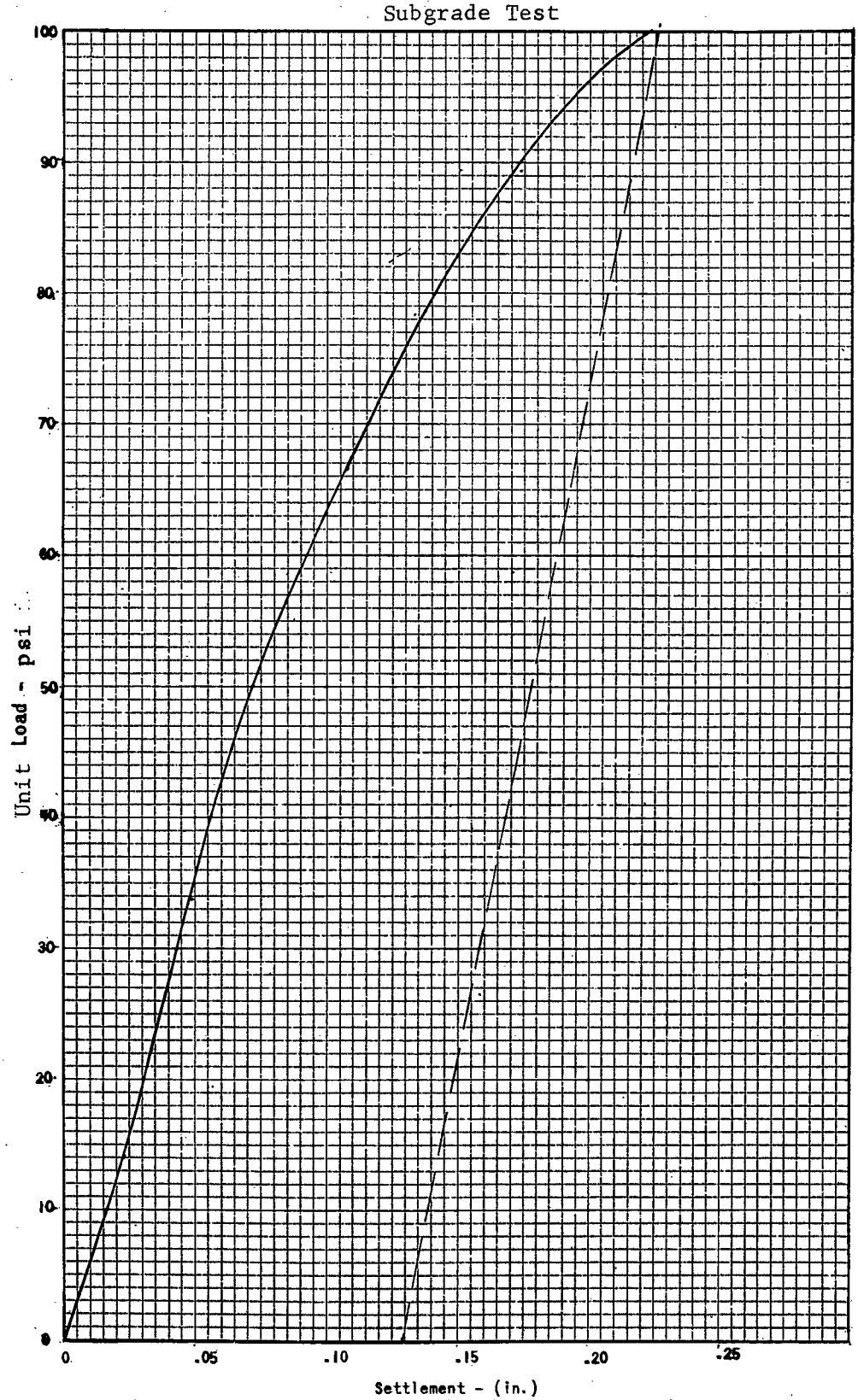


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	22+00

Subgrade Test



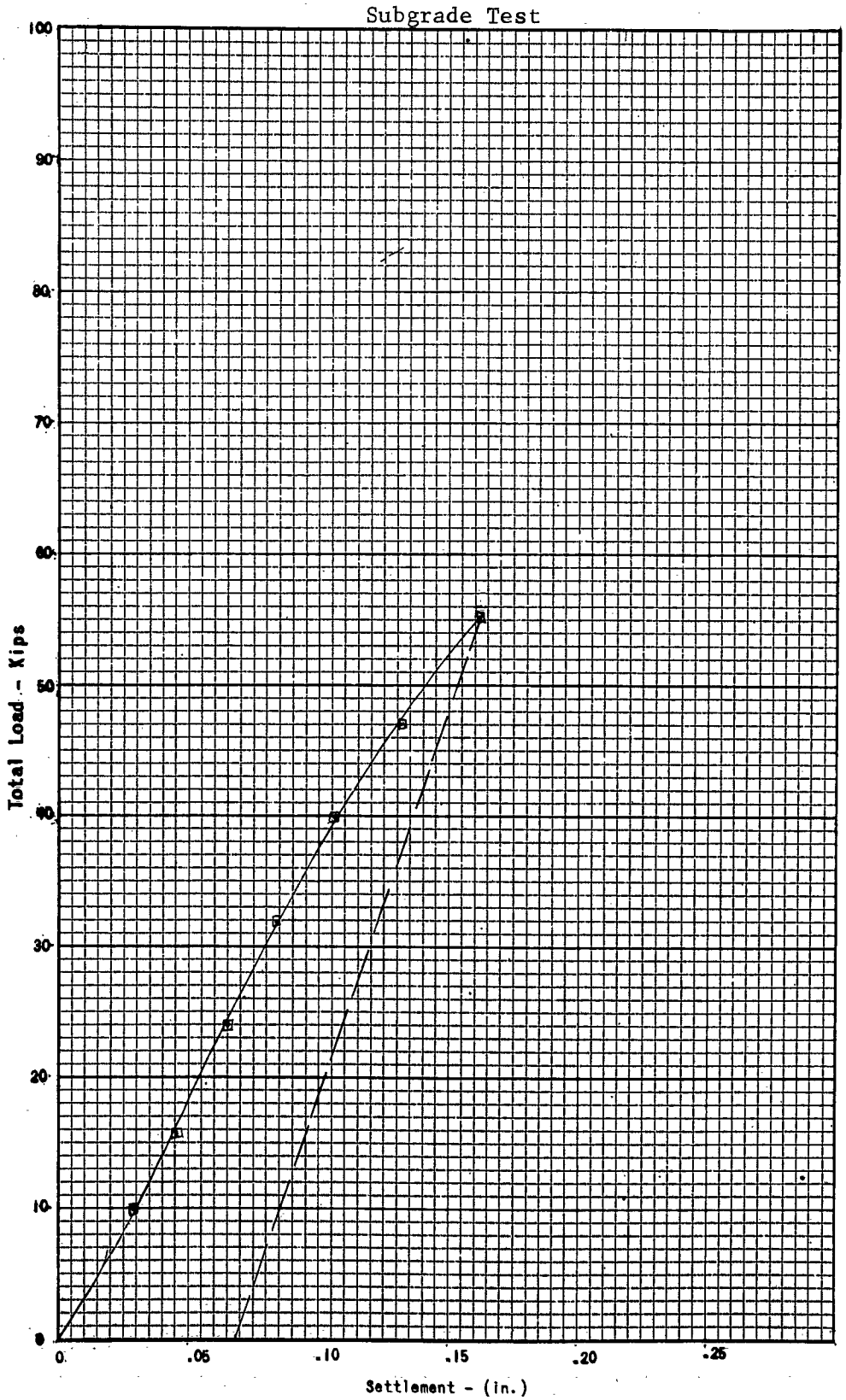
K = 710 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	32+00

Subgrade Test

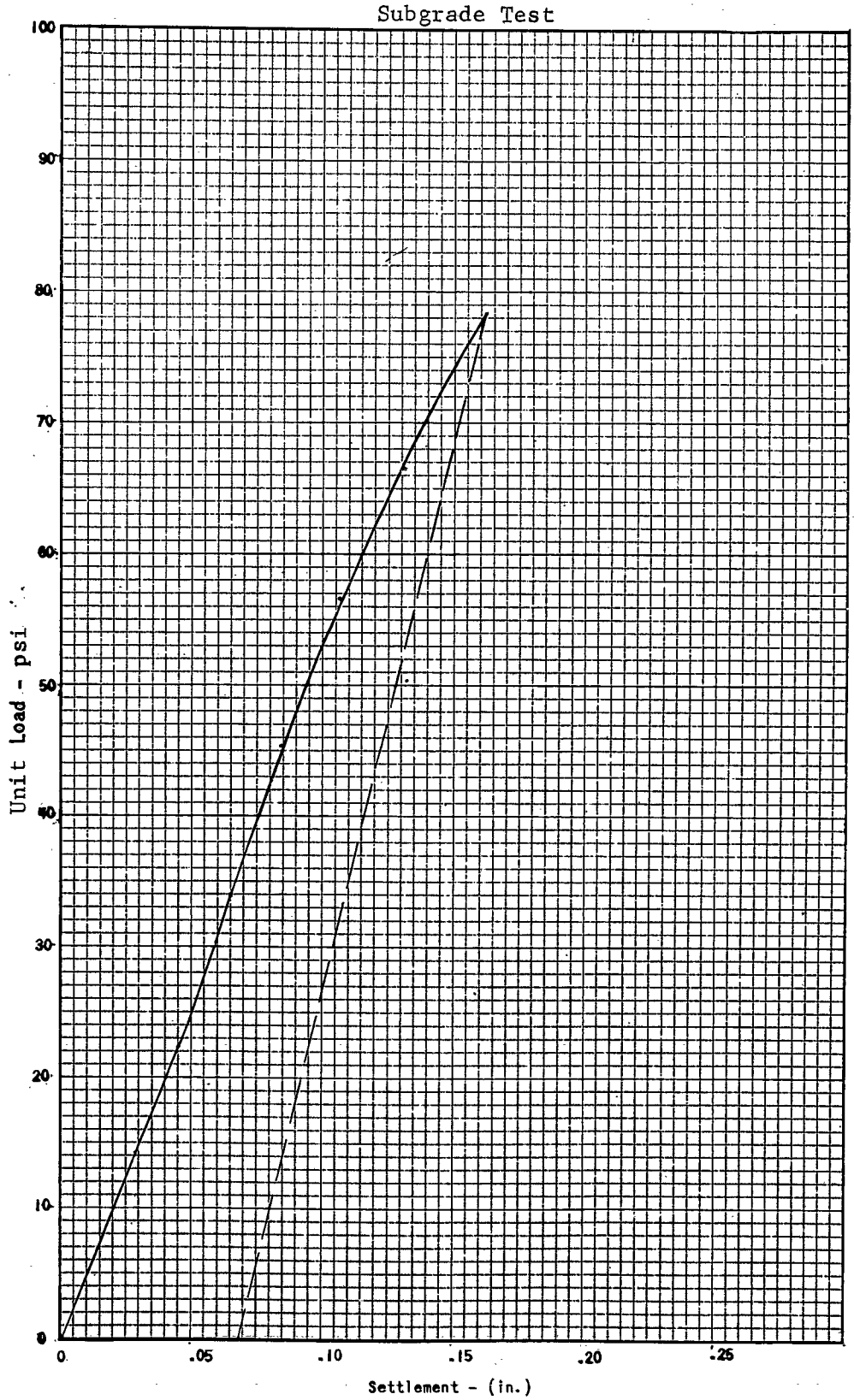


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	32+00

Subgrade Test



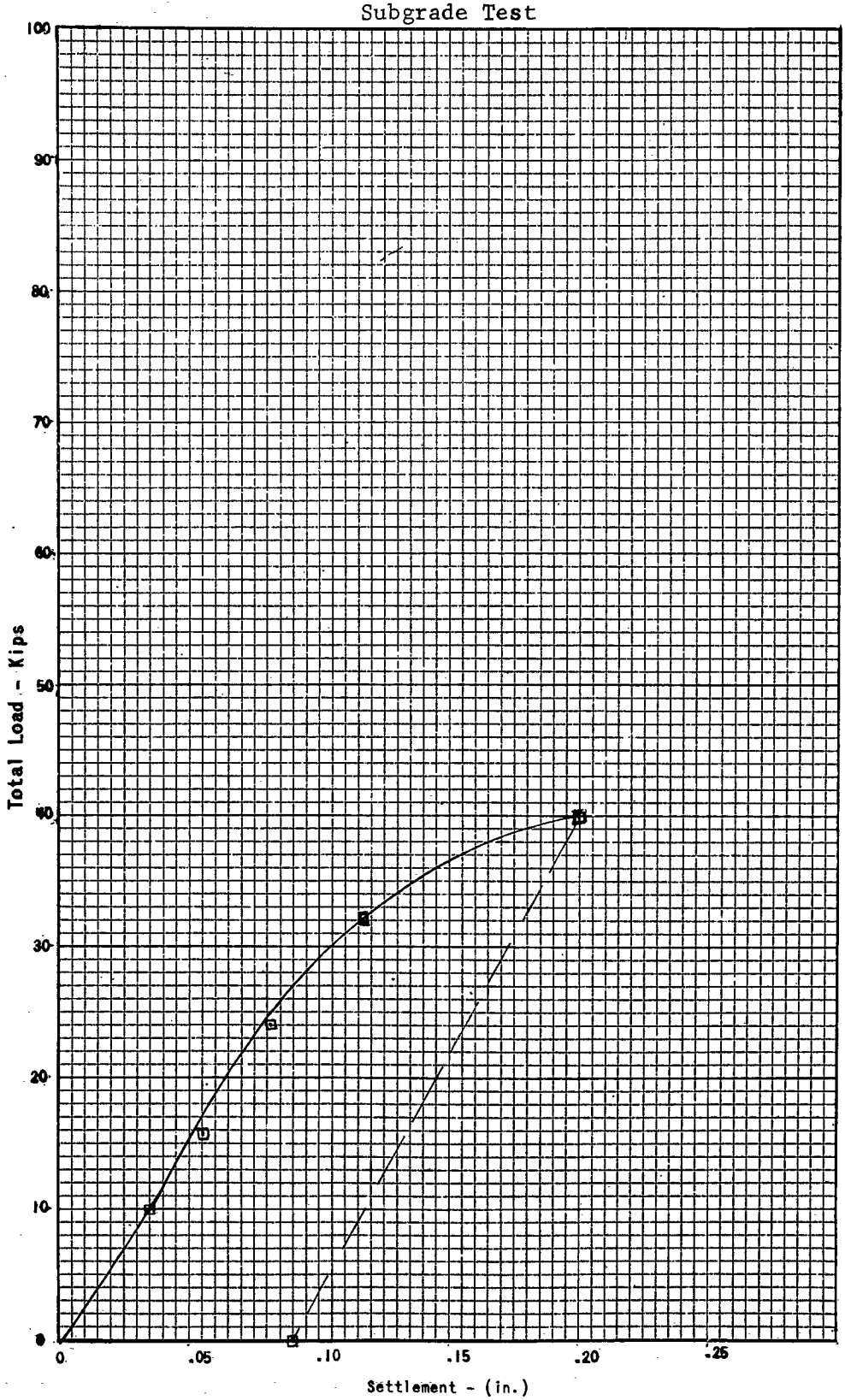
K = 490 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	41+00

Subgrade Test

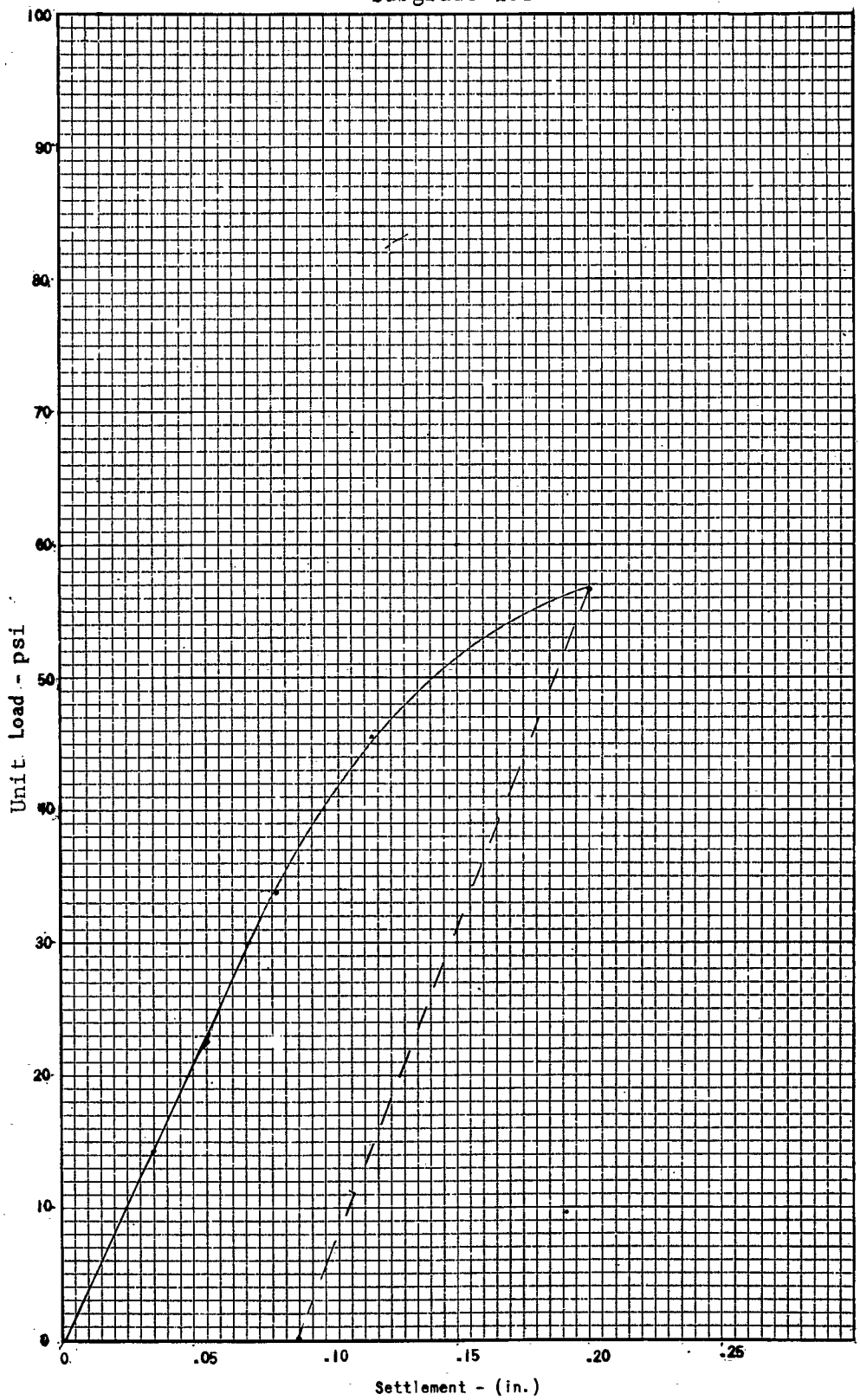


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	41+00

Subgrade Test



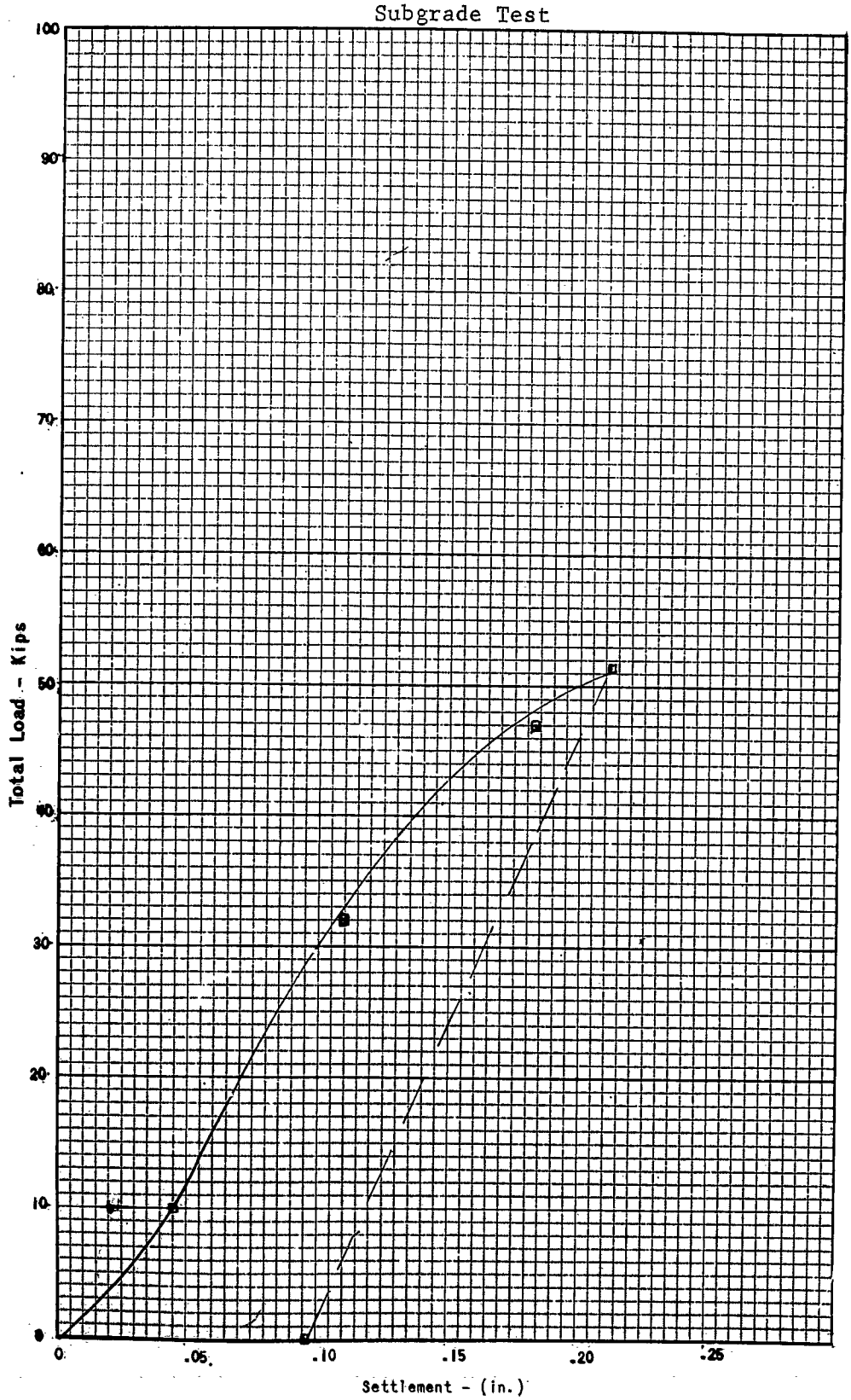
K = 420 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-A	5+00

Subgrade Test

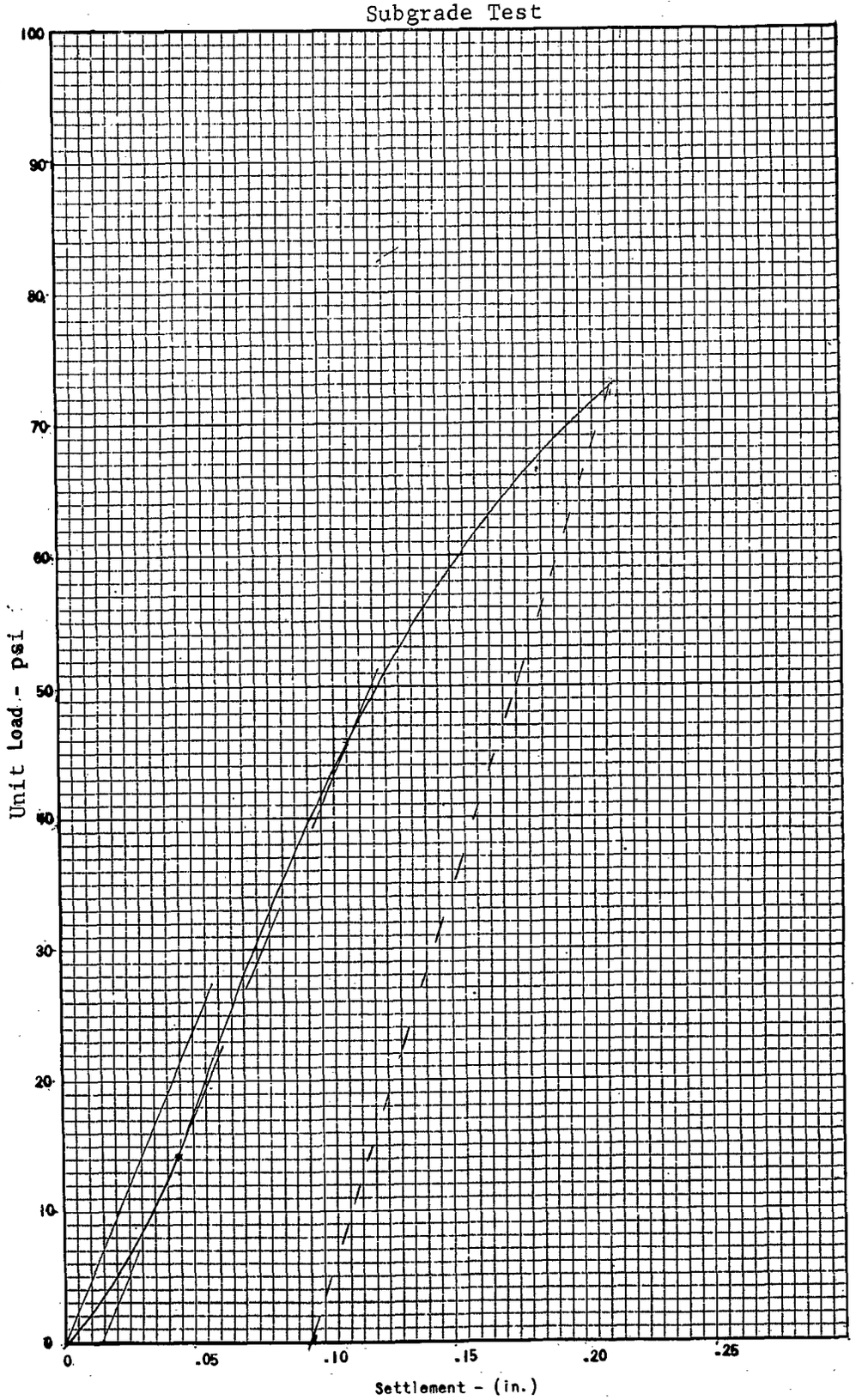


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1-A	5+00

Subgrade Test



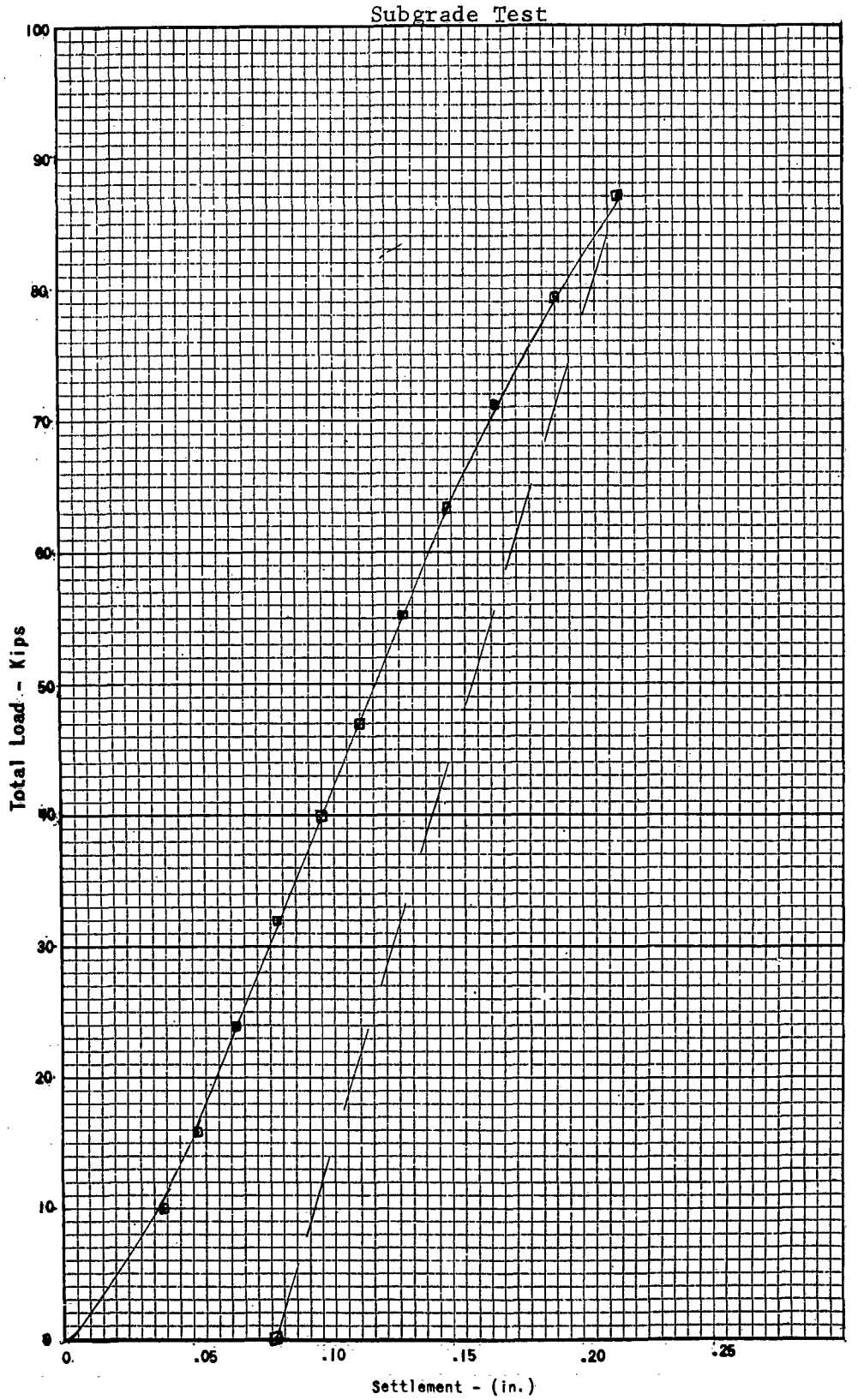
K = 470 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	2+00

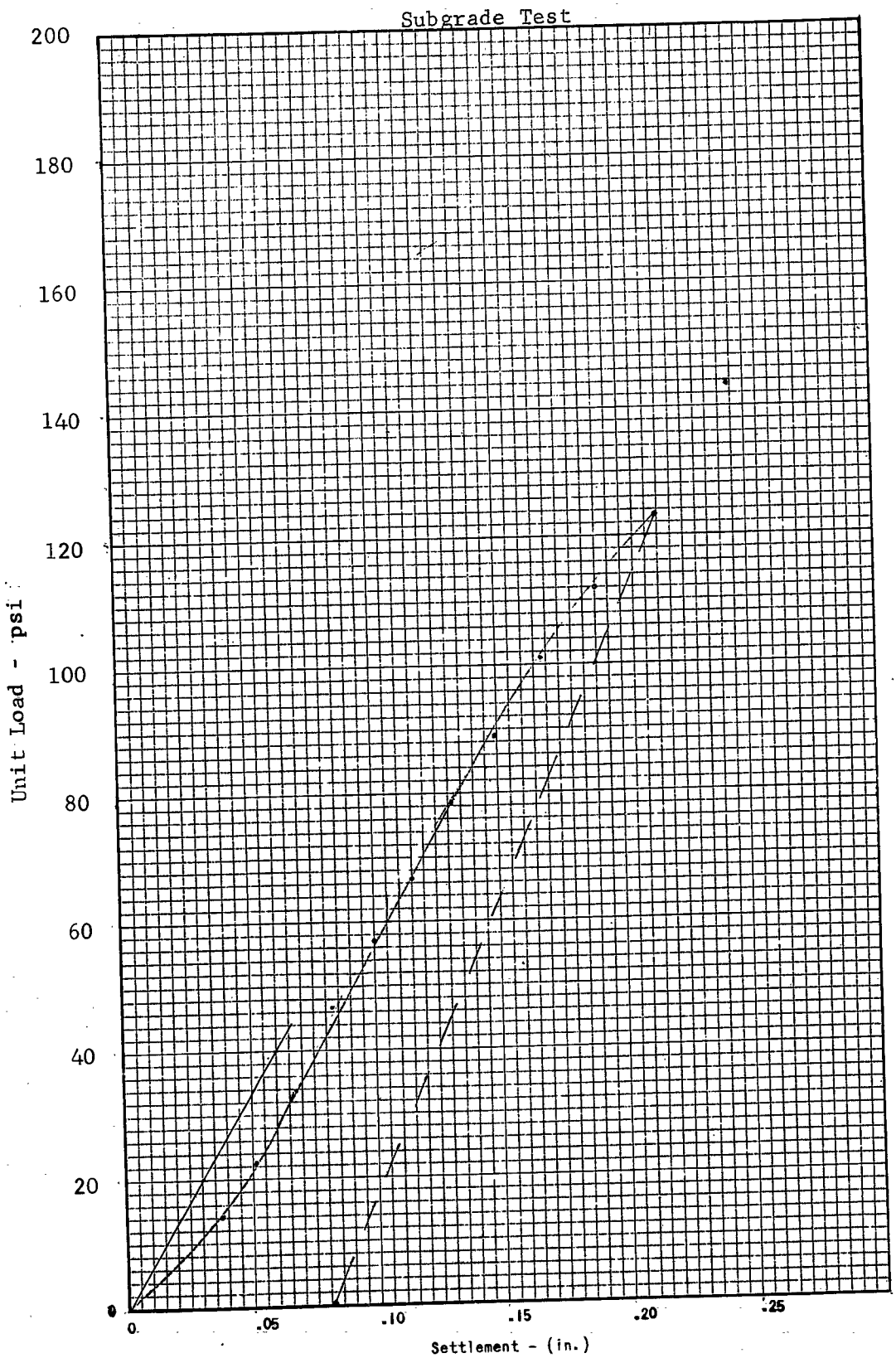
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	2+00



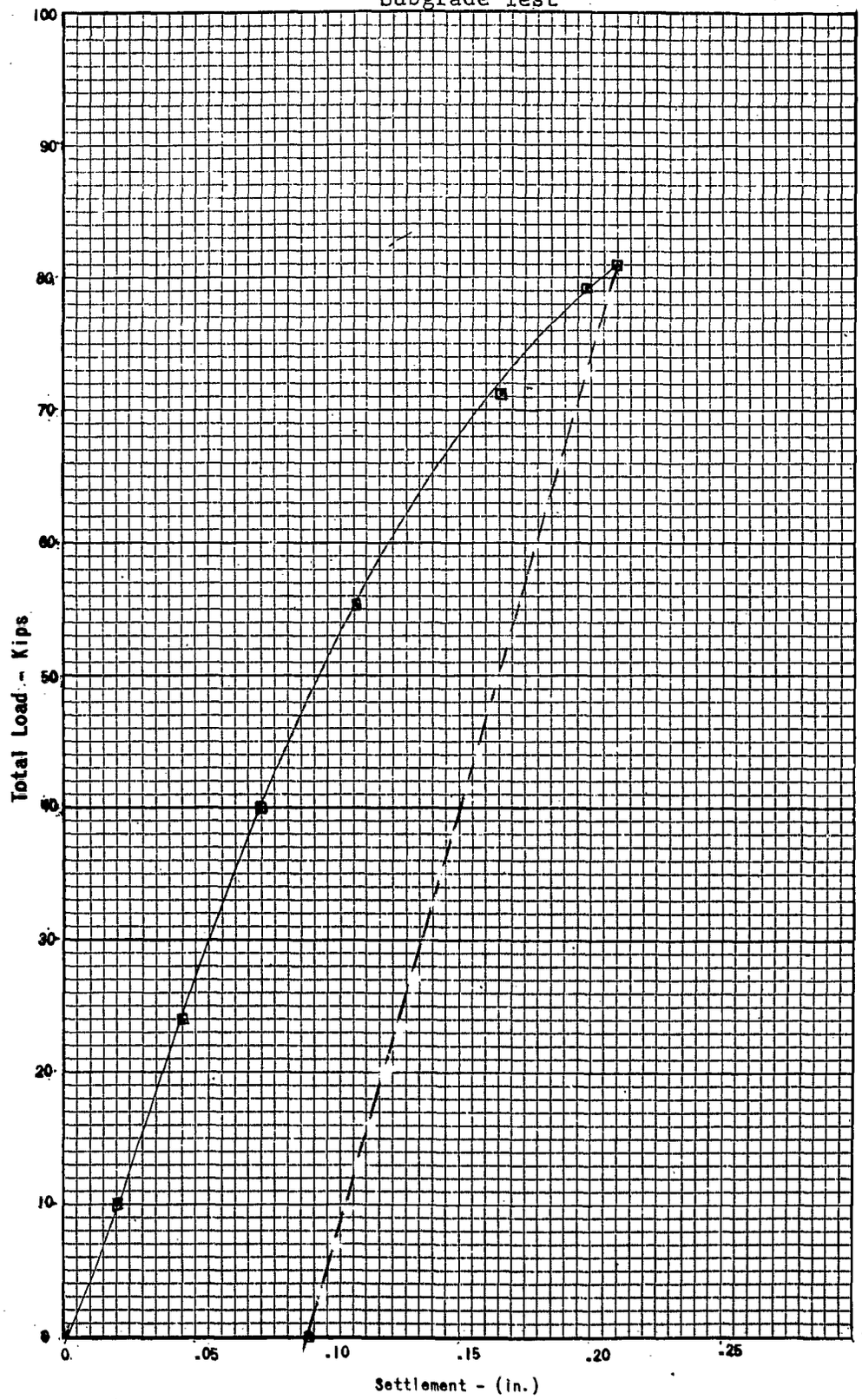
K = 670 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	9+00

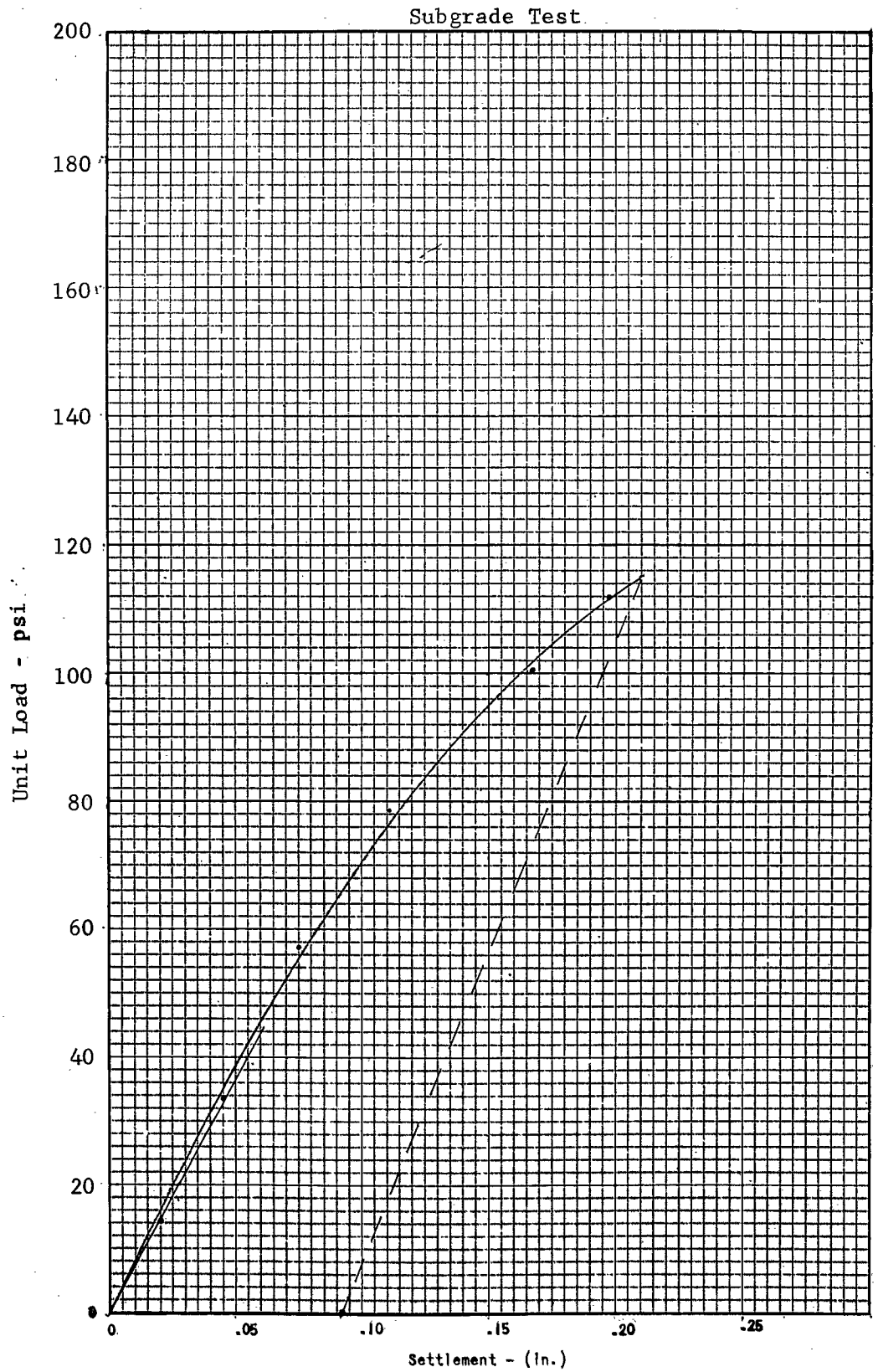
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 2	9+00



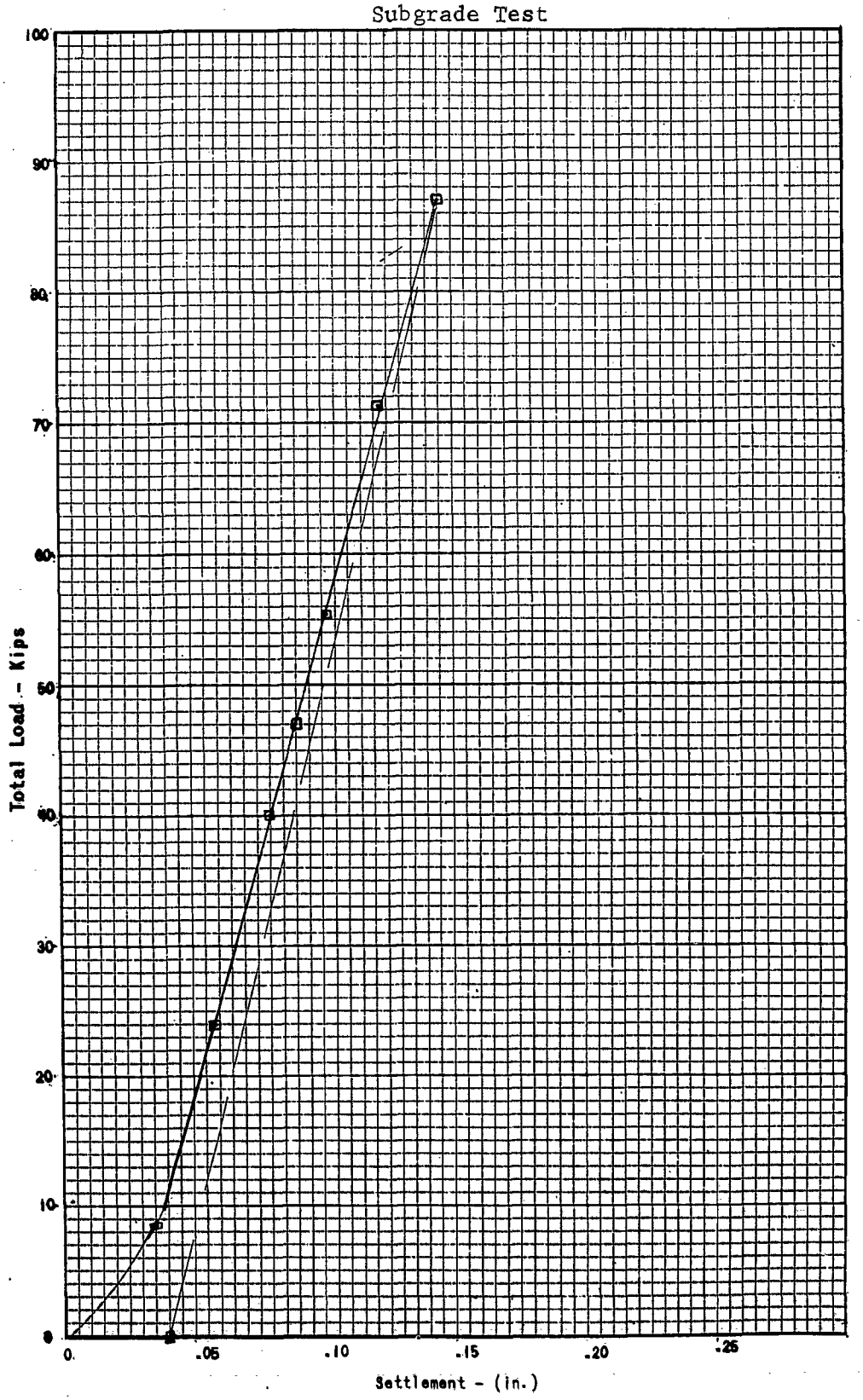
K = 730 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

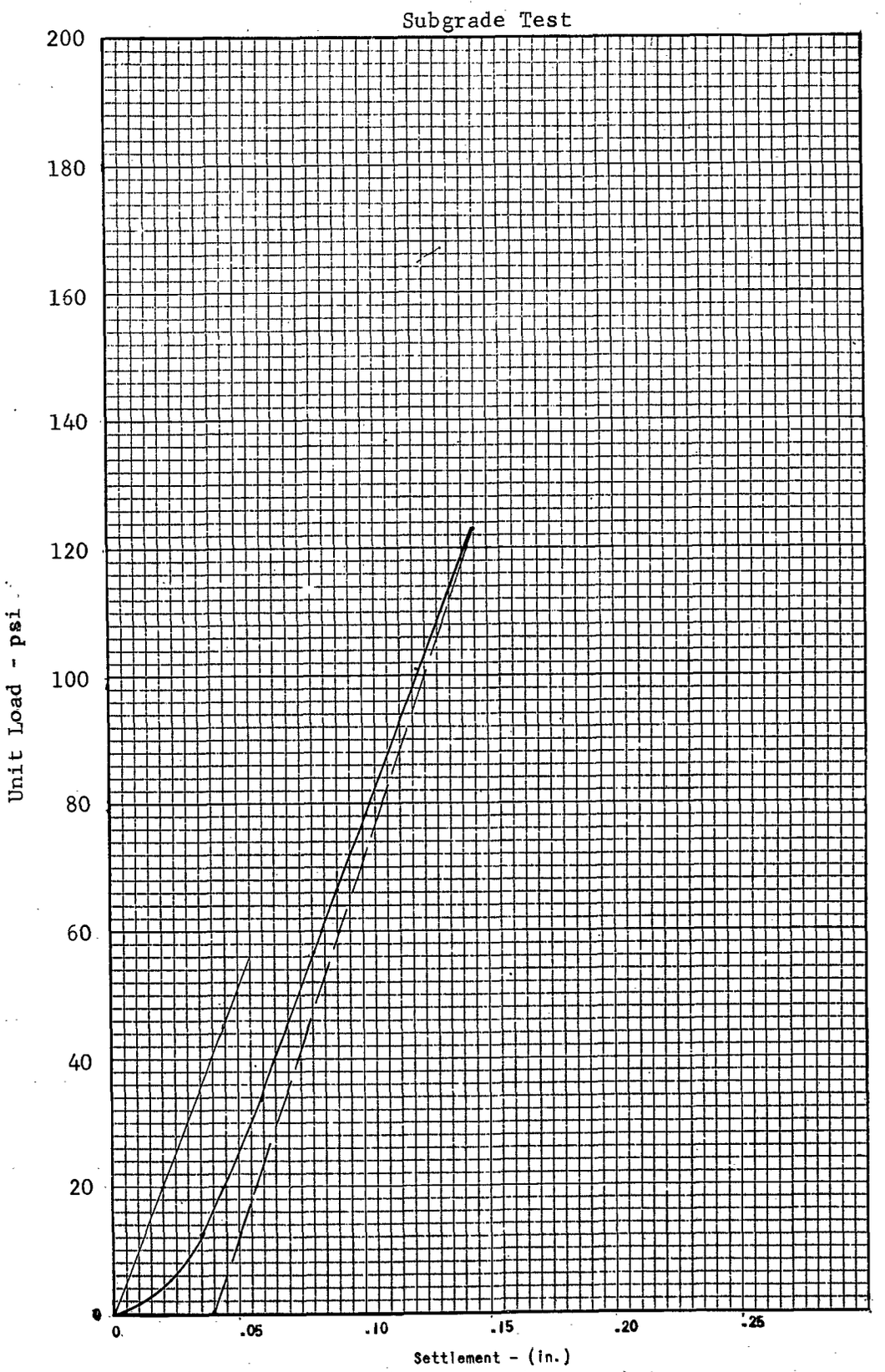
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	1+50 Offset

Subgrade Test



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	1+50 Offset



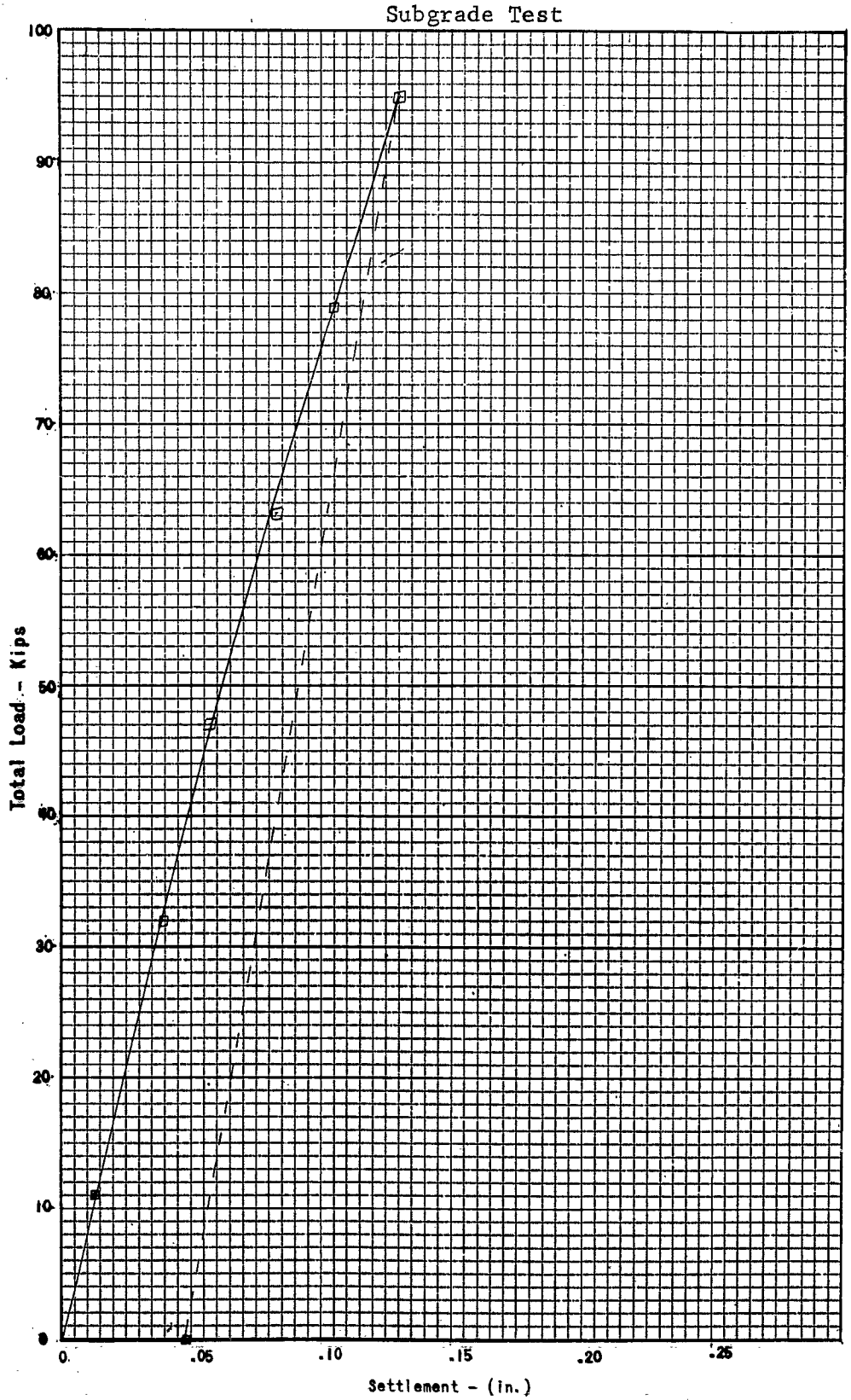
K = 1020 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	6+00

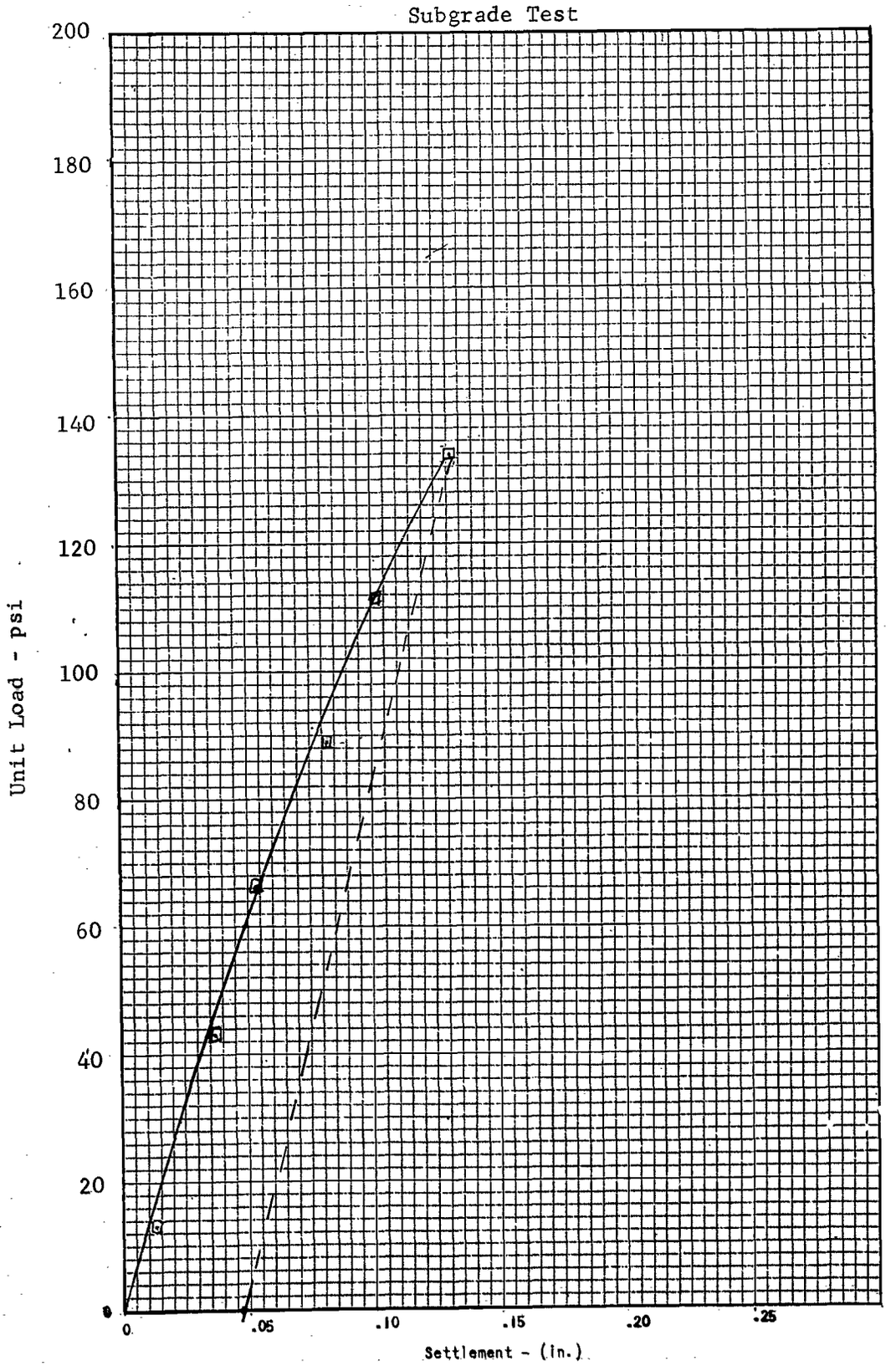
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	6+00



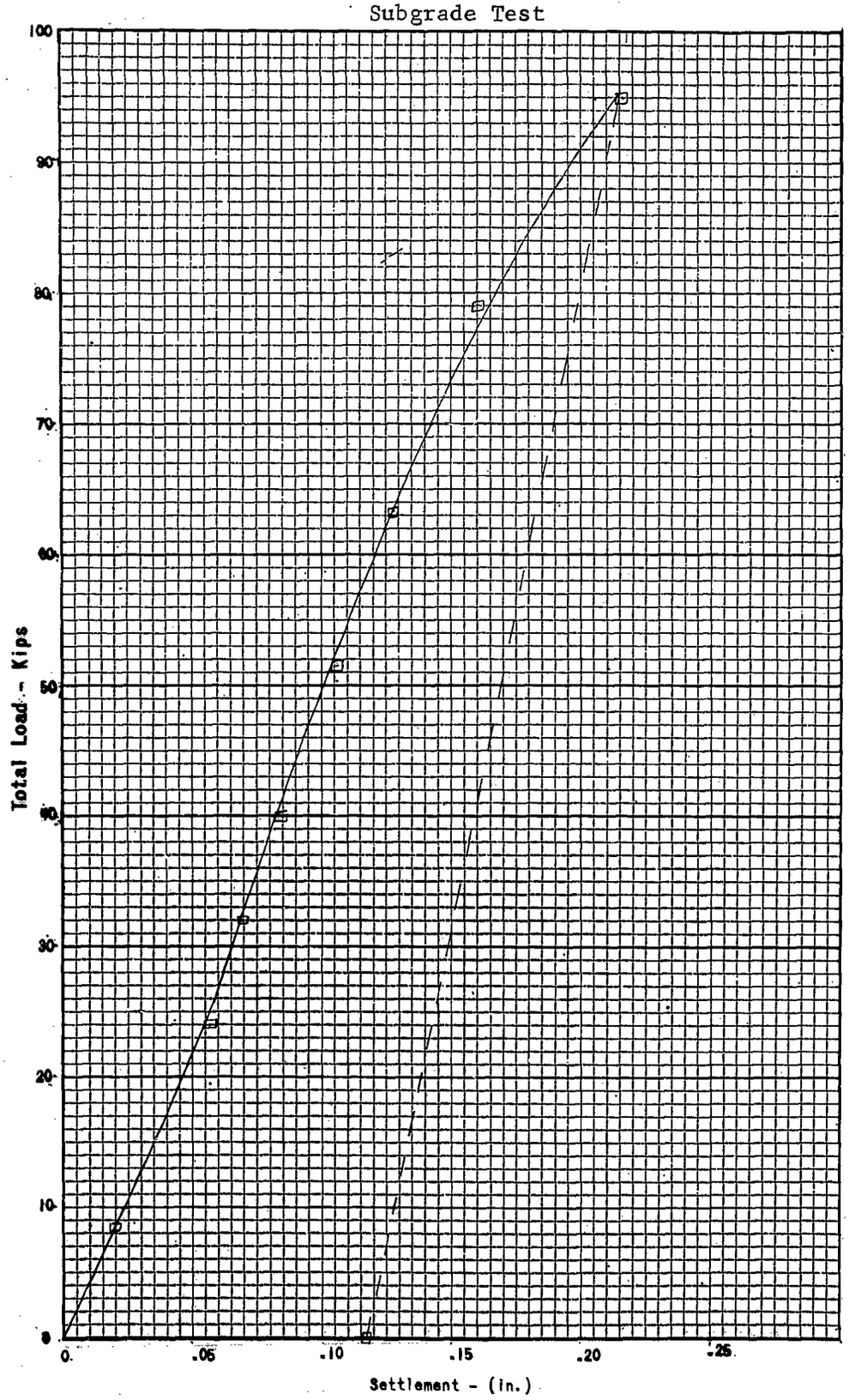
K = 1220 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	14+00

Subgrade Test

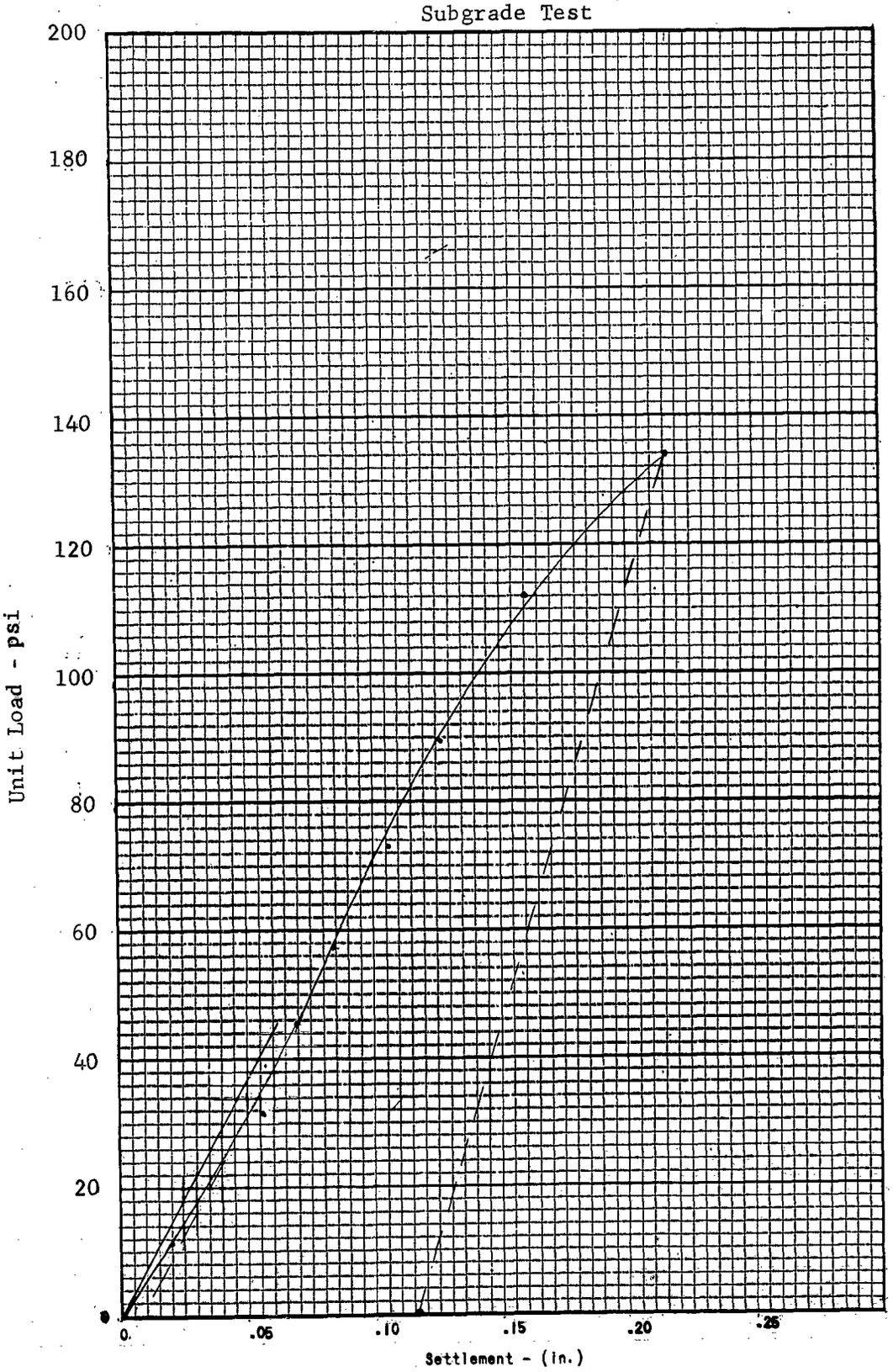


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6	14+00

Subgrade Test



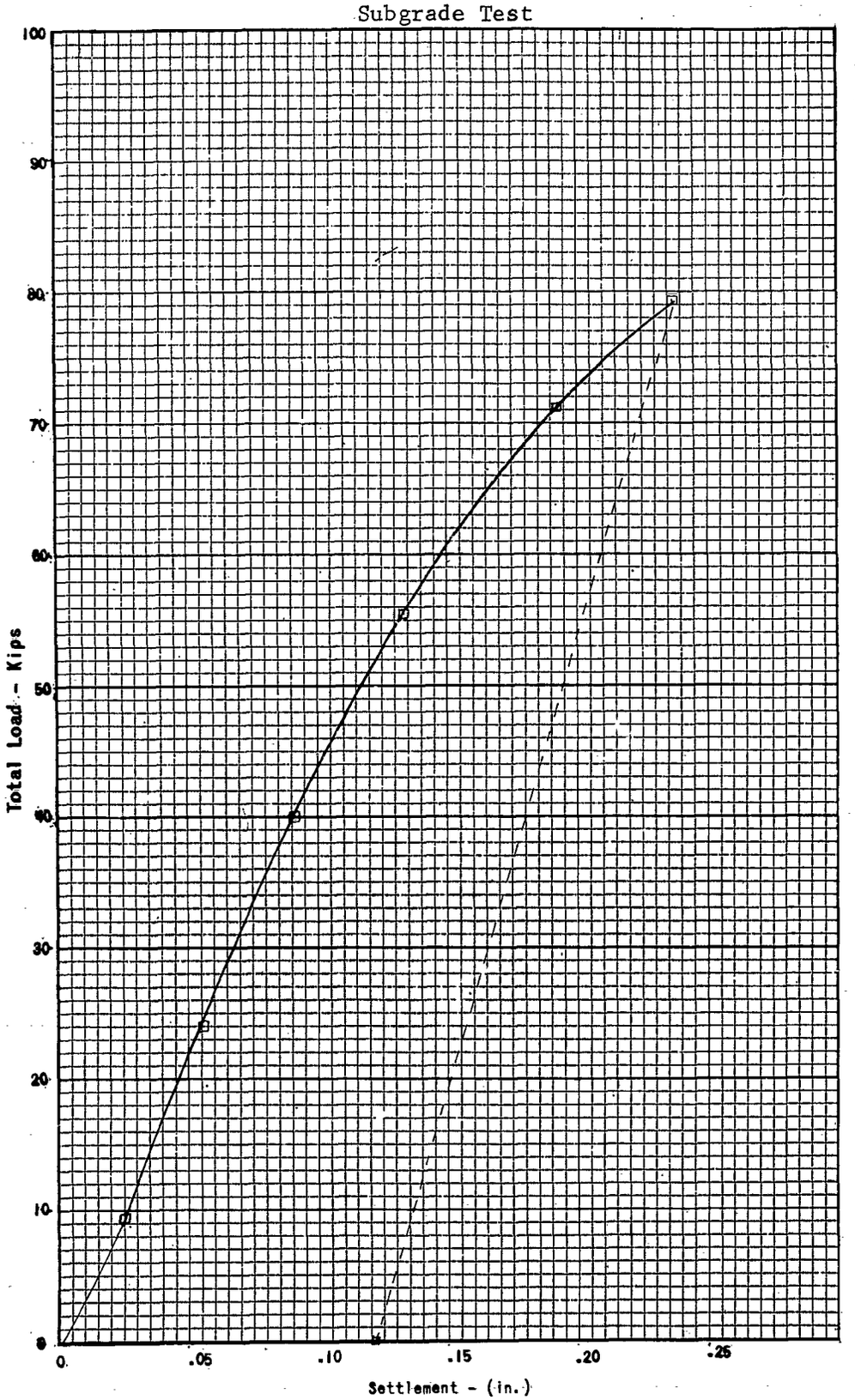
K = 730 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	6+00

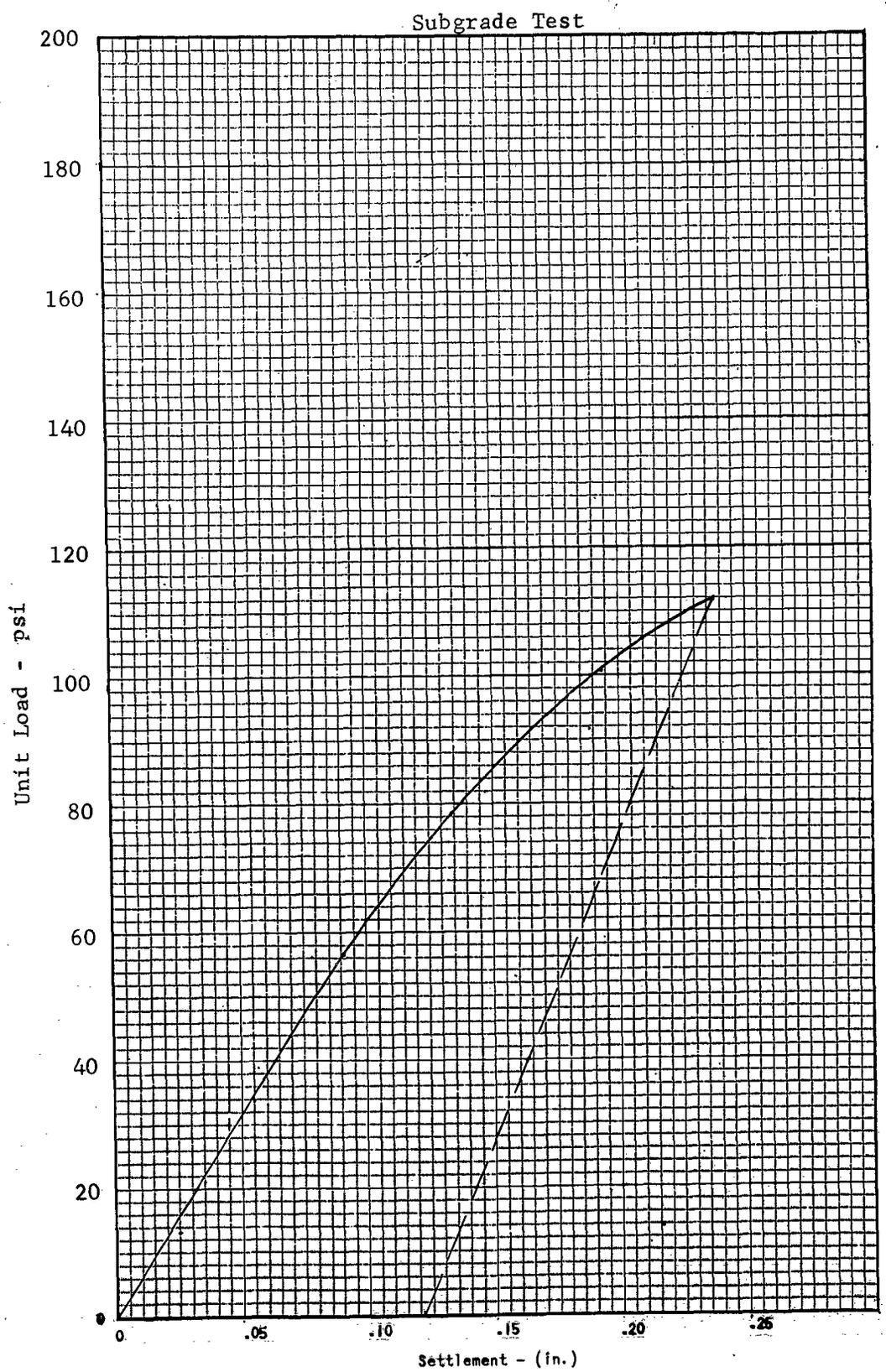
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
US MCAS Yuma, Arizona	Taxiway 6-A	6+00

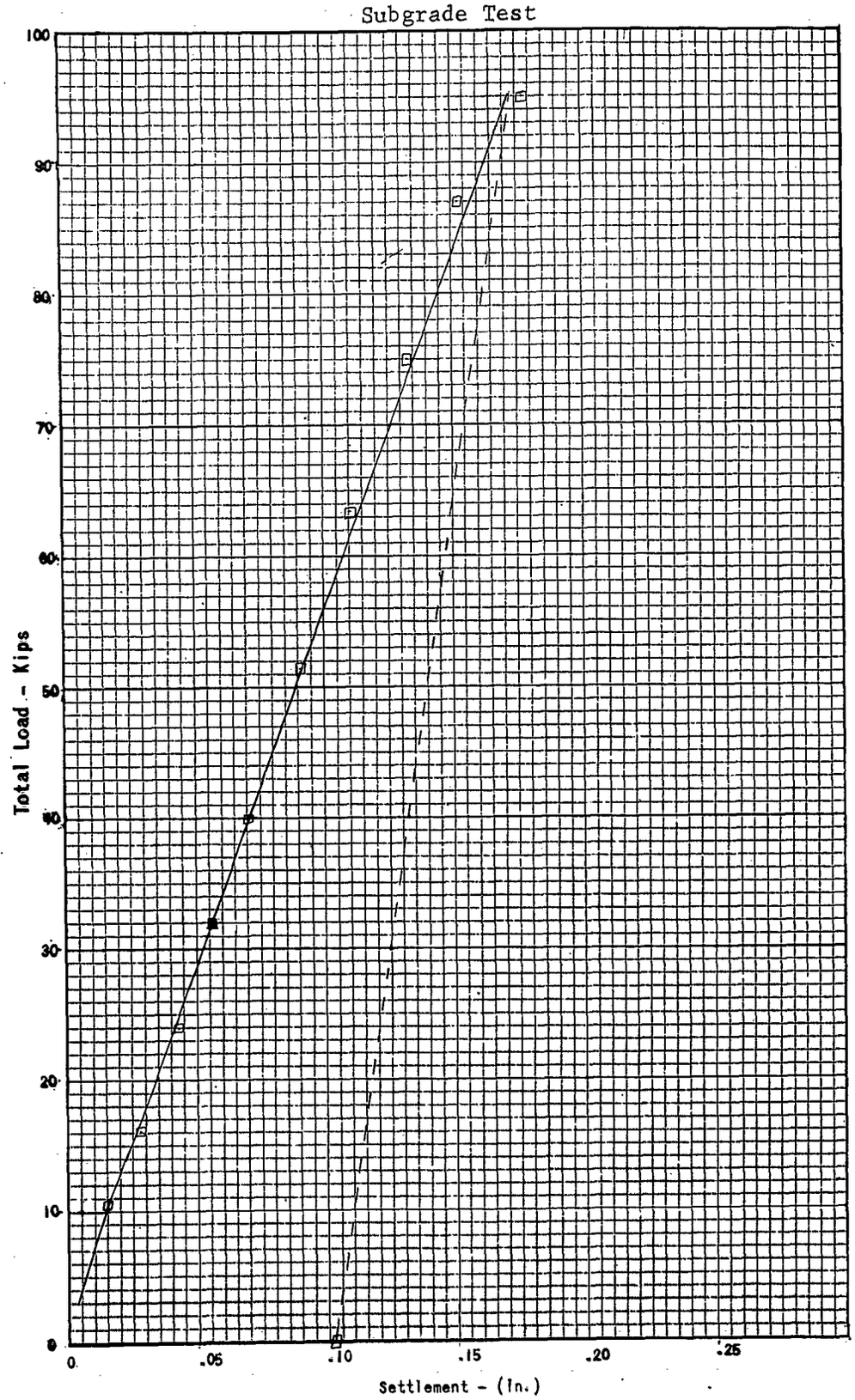


K = 640 pci

IIND NCEL 3960/20 (1-64) TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	16+00

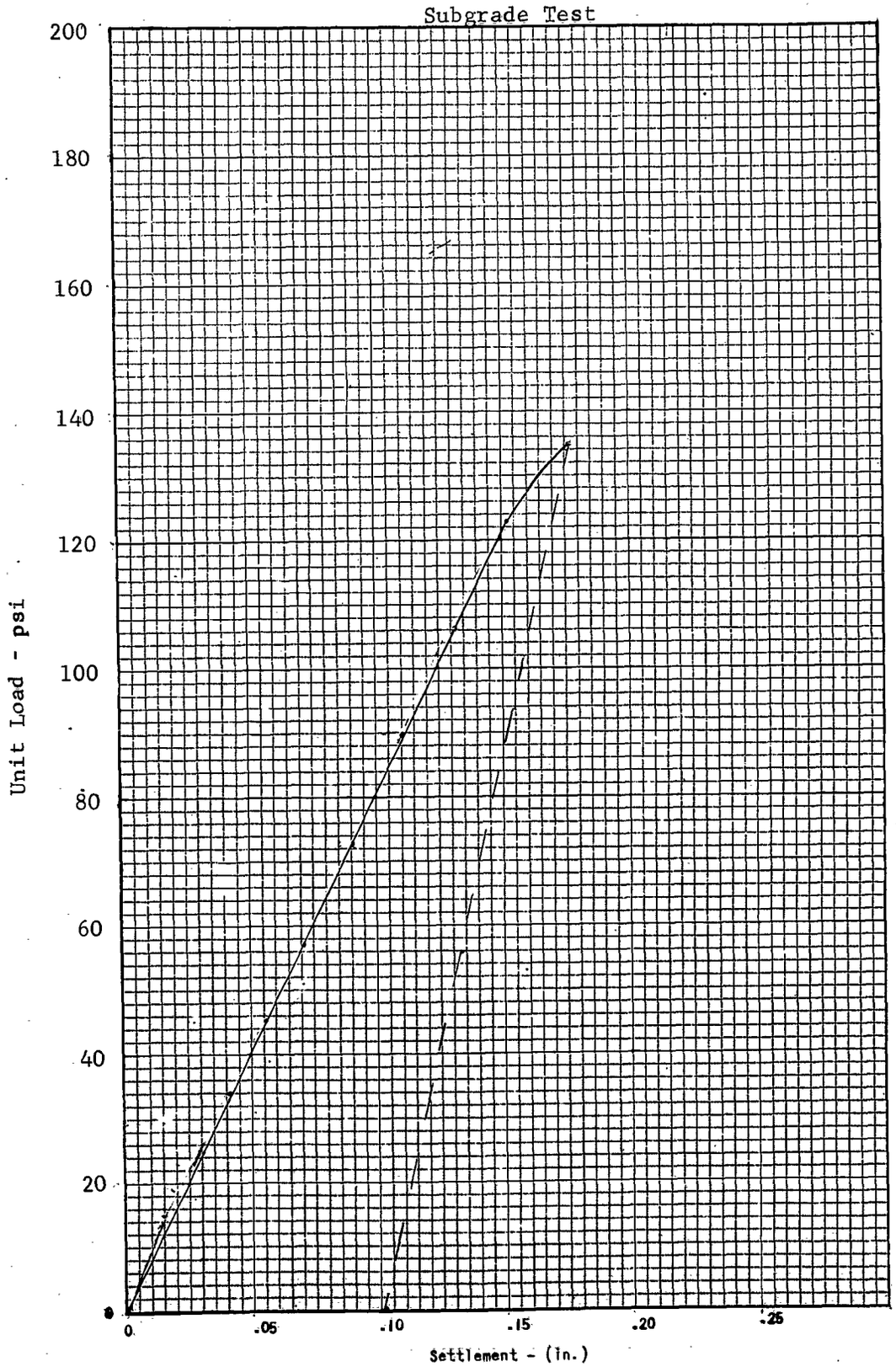
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 6-A	16+00

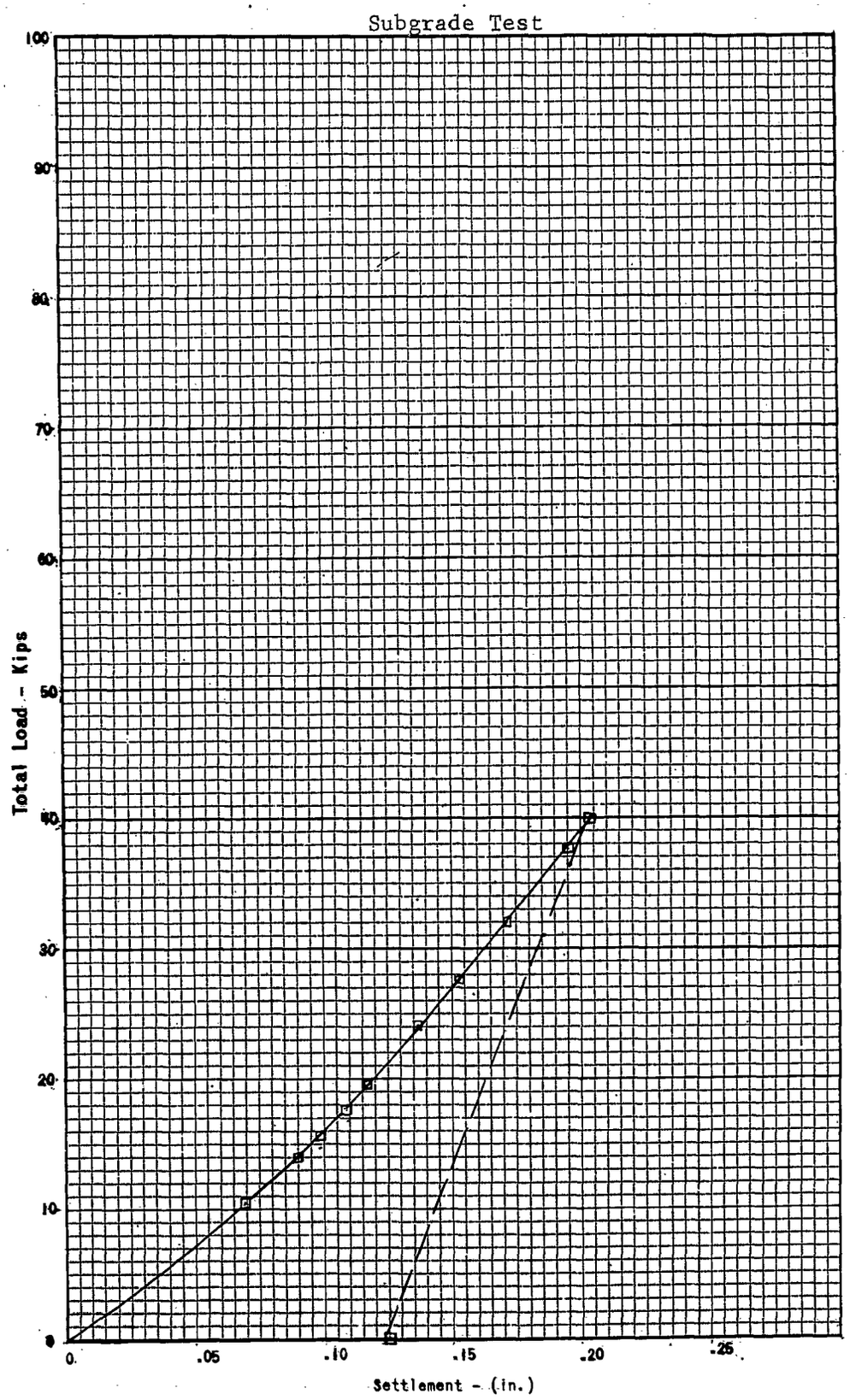


K = 800 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	7+00

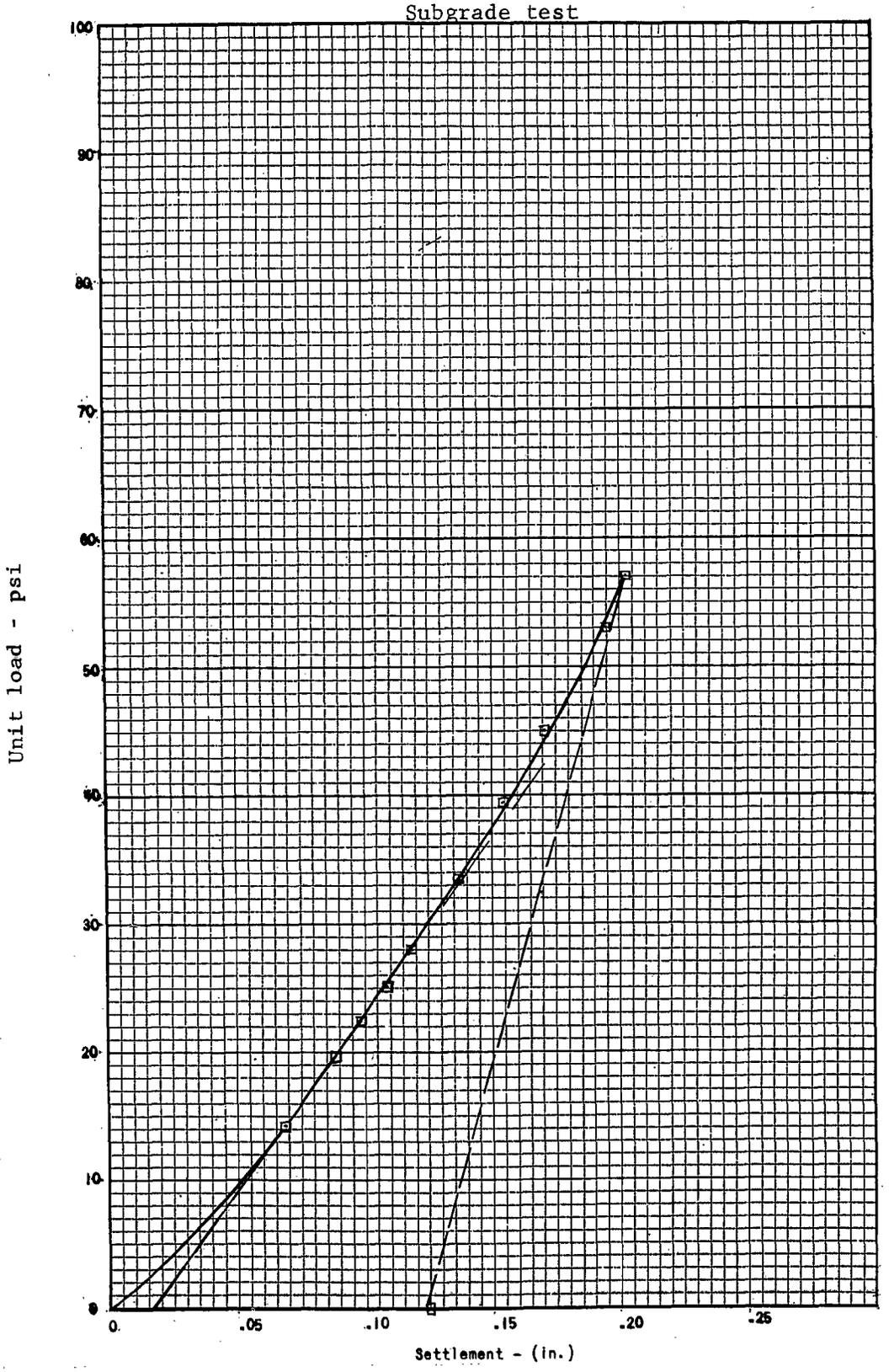


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	7+00

Subgrade test



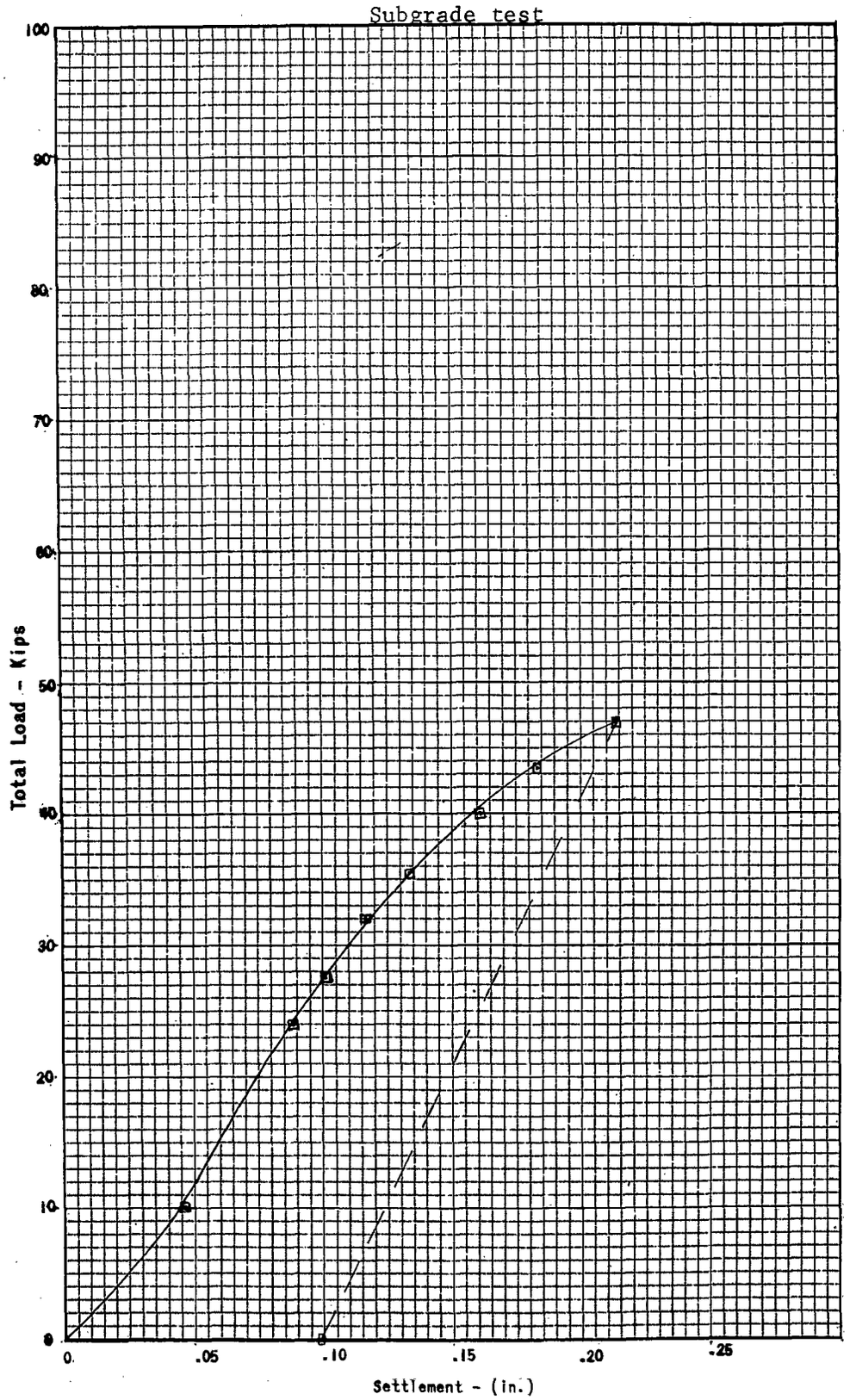
K = 280 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	19+00

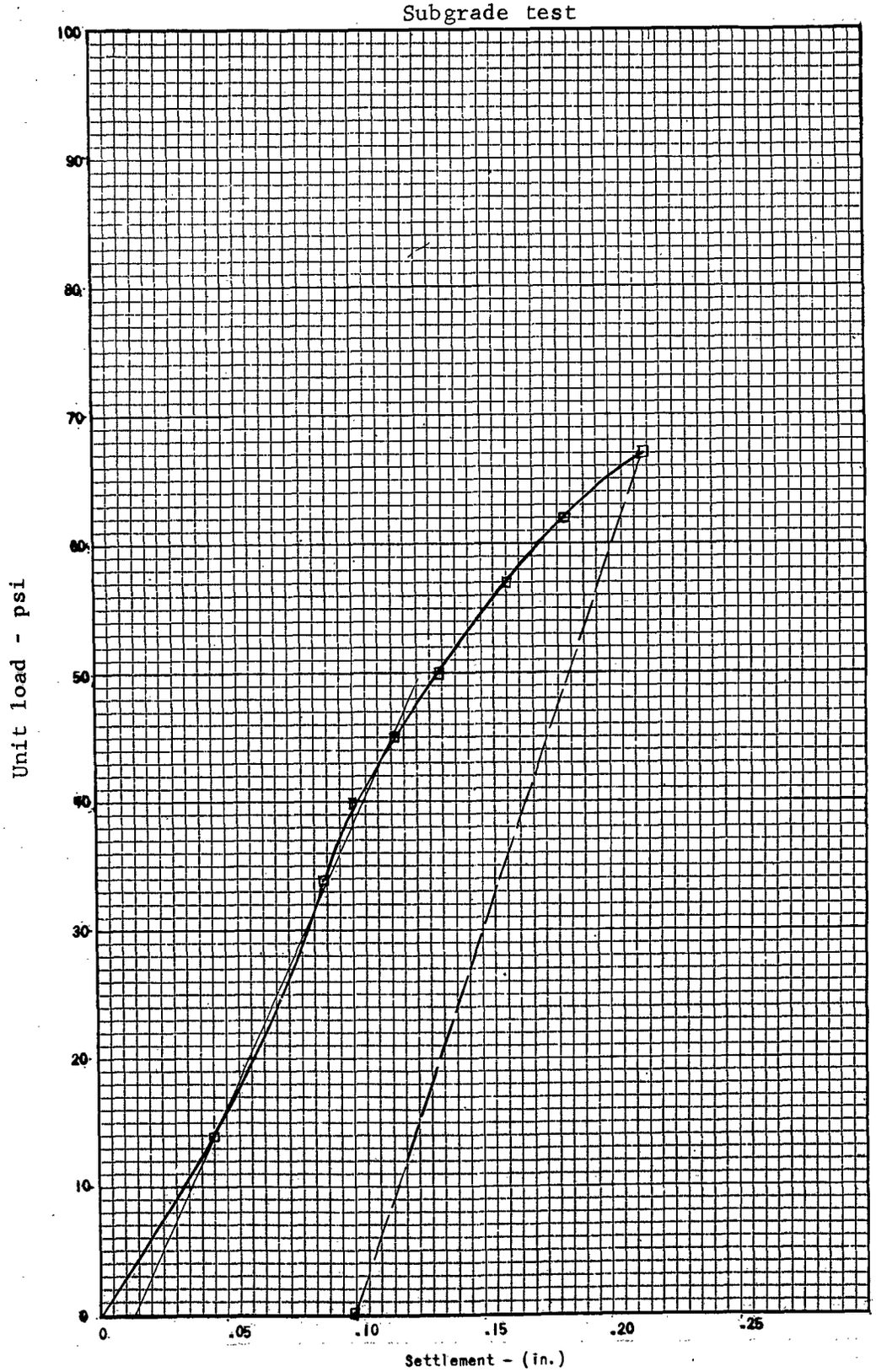
Subgrade test



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	19+00

Subgrade test



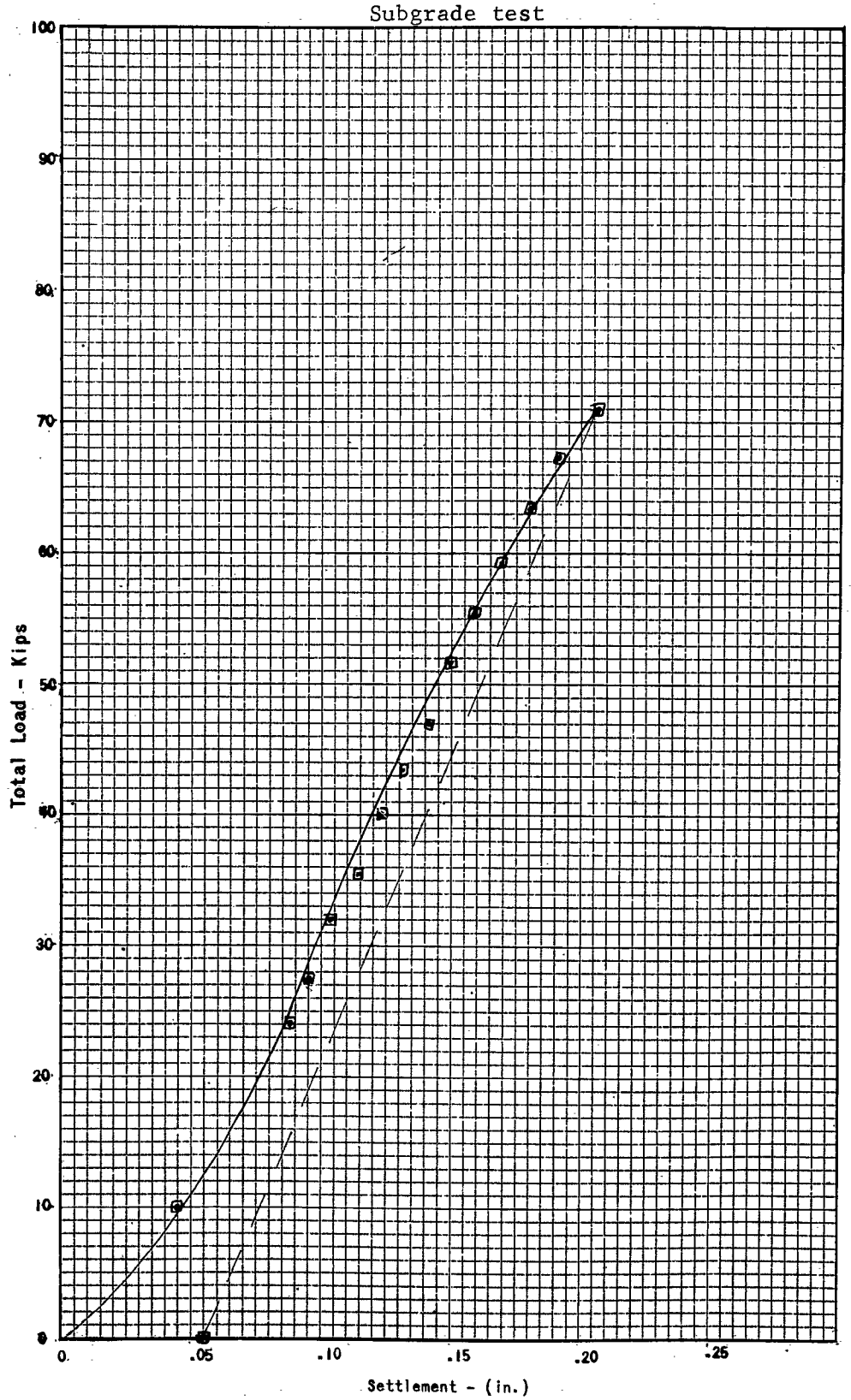
K = 440 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	29+00

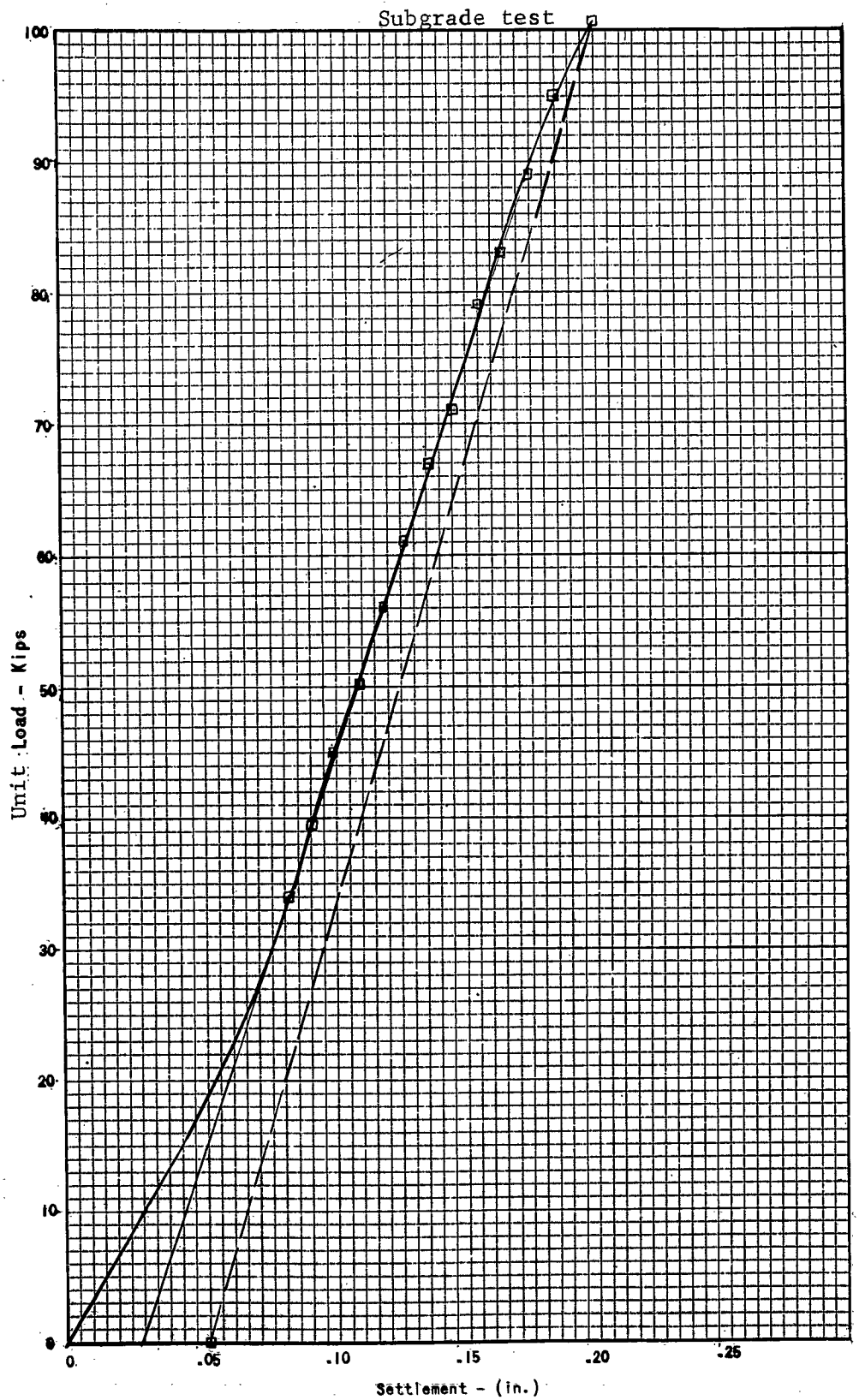
Subgrade test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	29+00



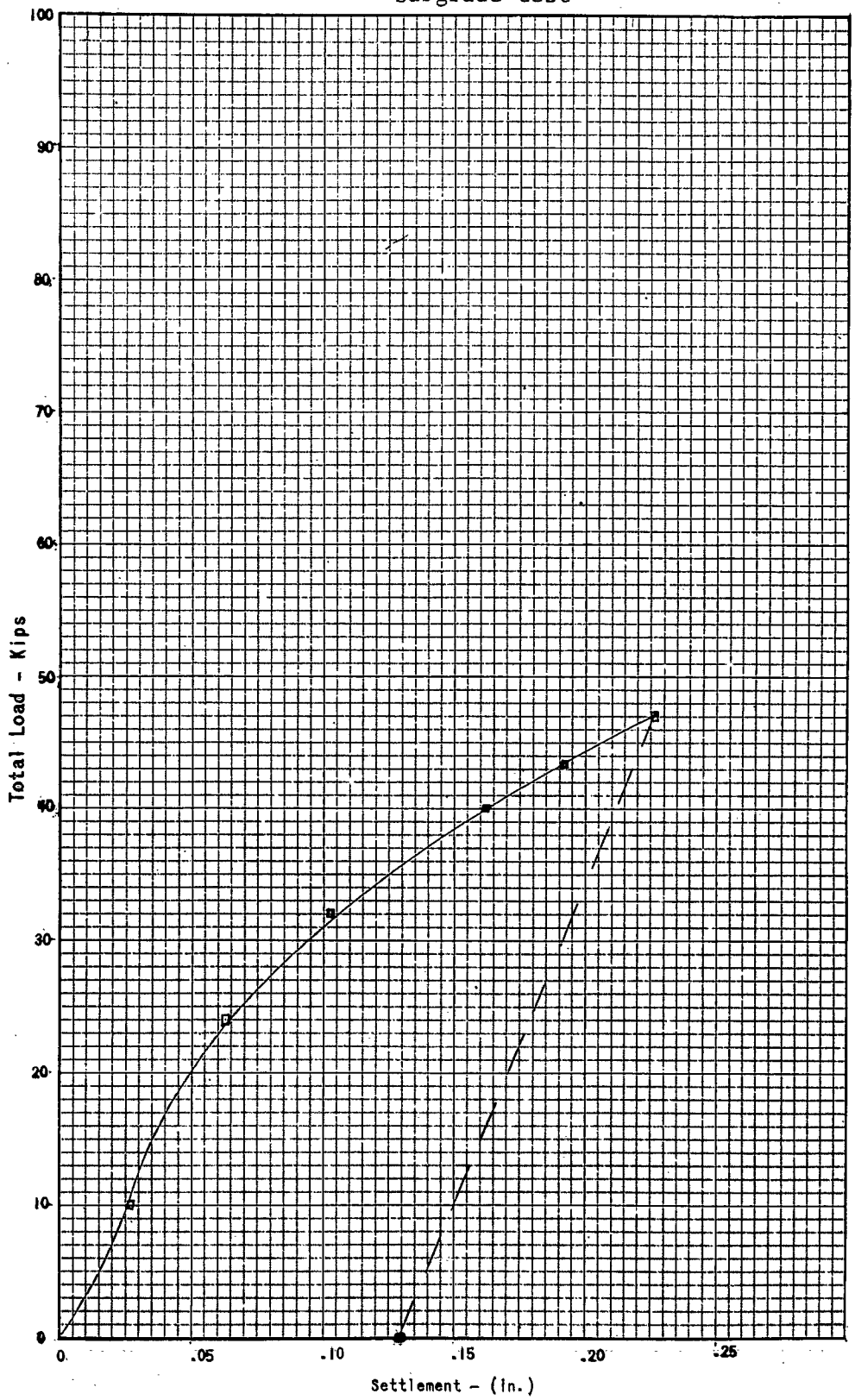
K = 590 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	39+00

Subgrade test

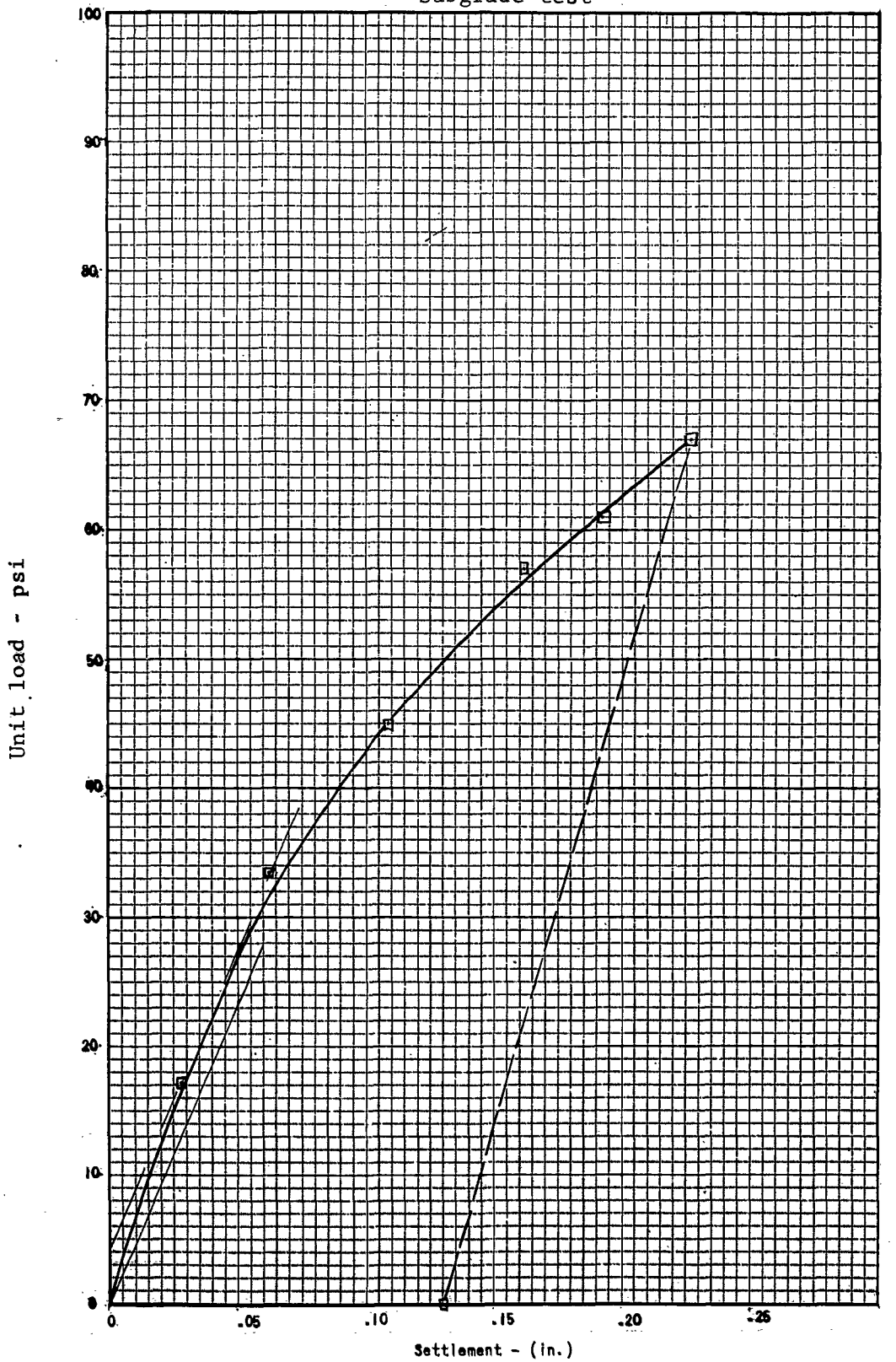


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	39+00

Subgrade test



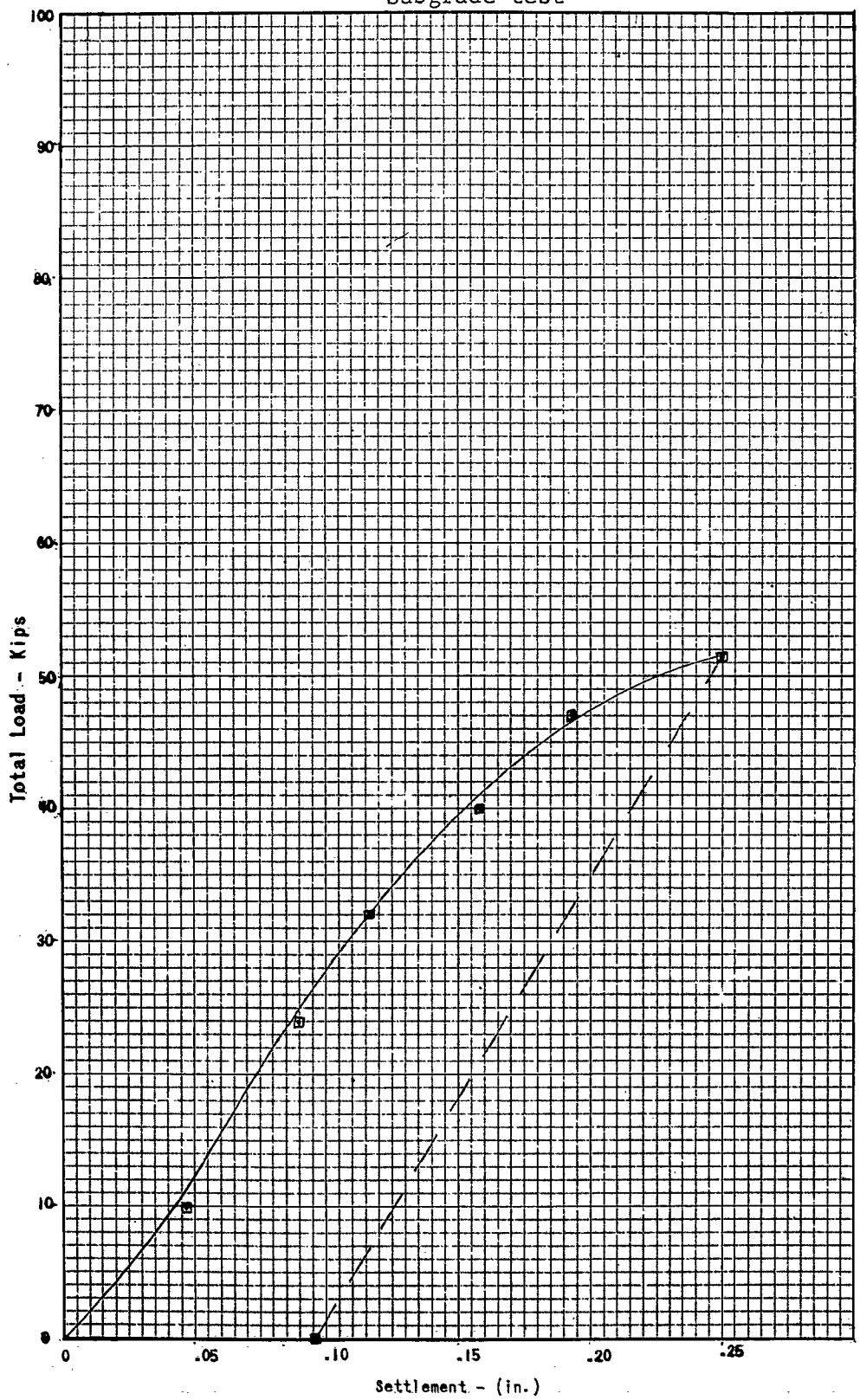
K = 470 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	49+00

Subgrade test

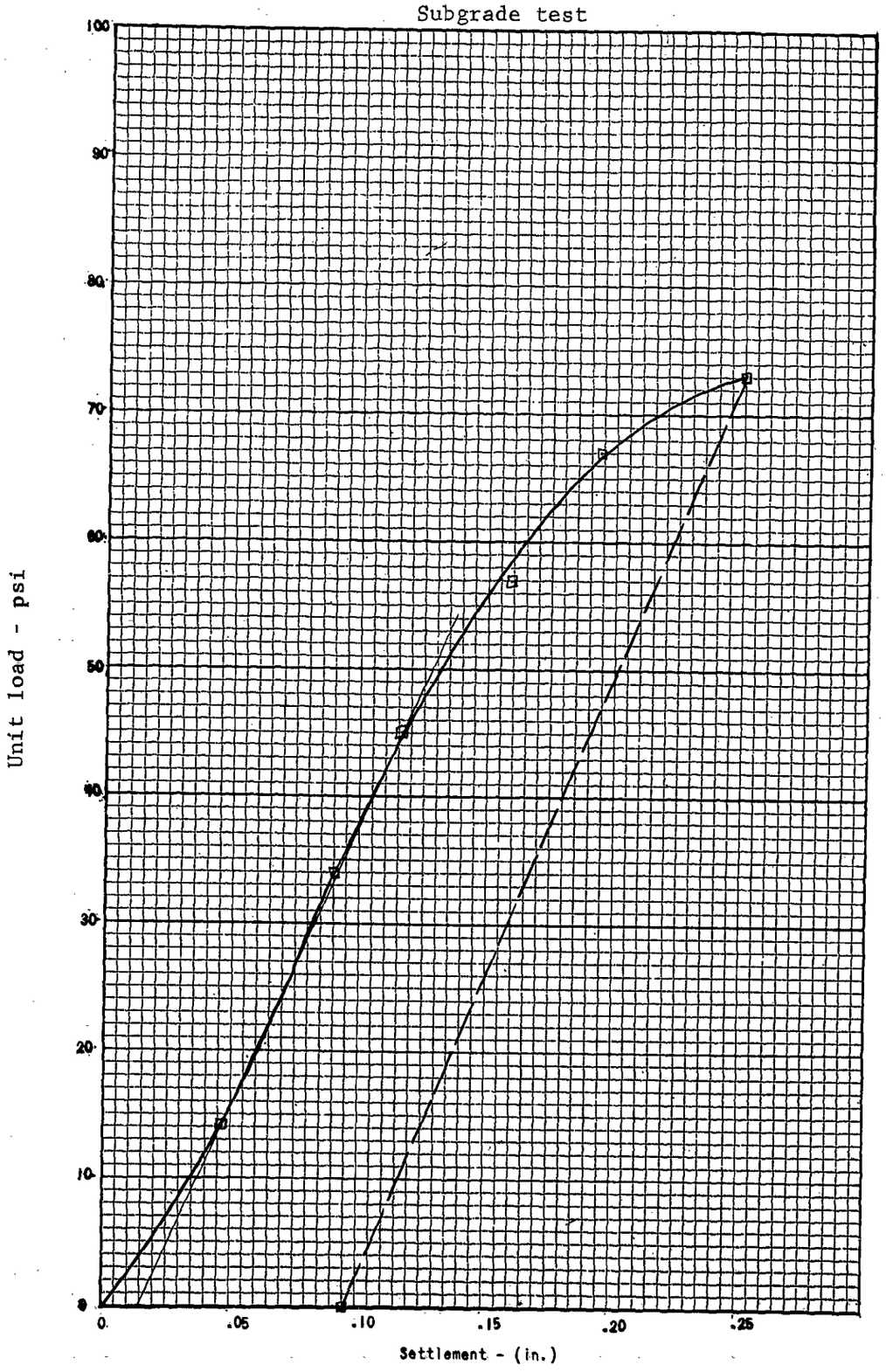


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 17-35	49+00

Subgrade test



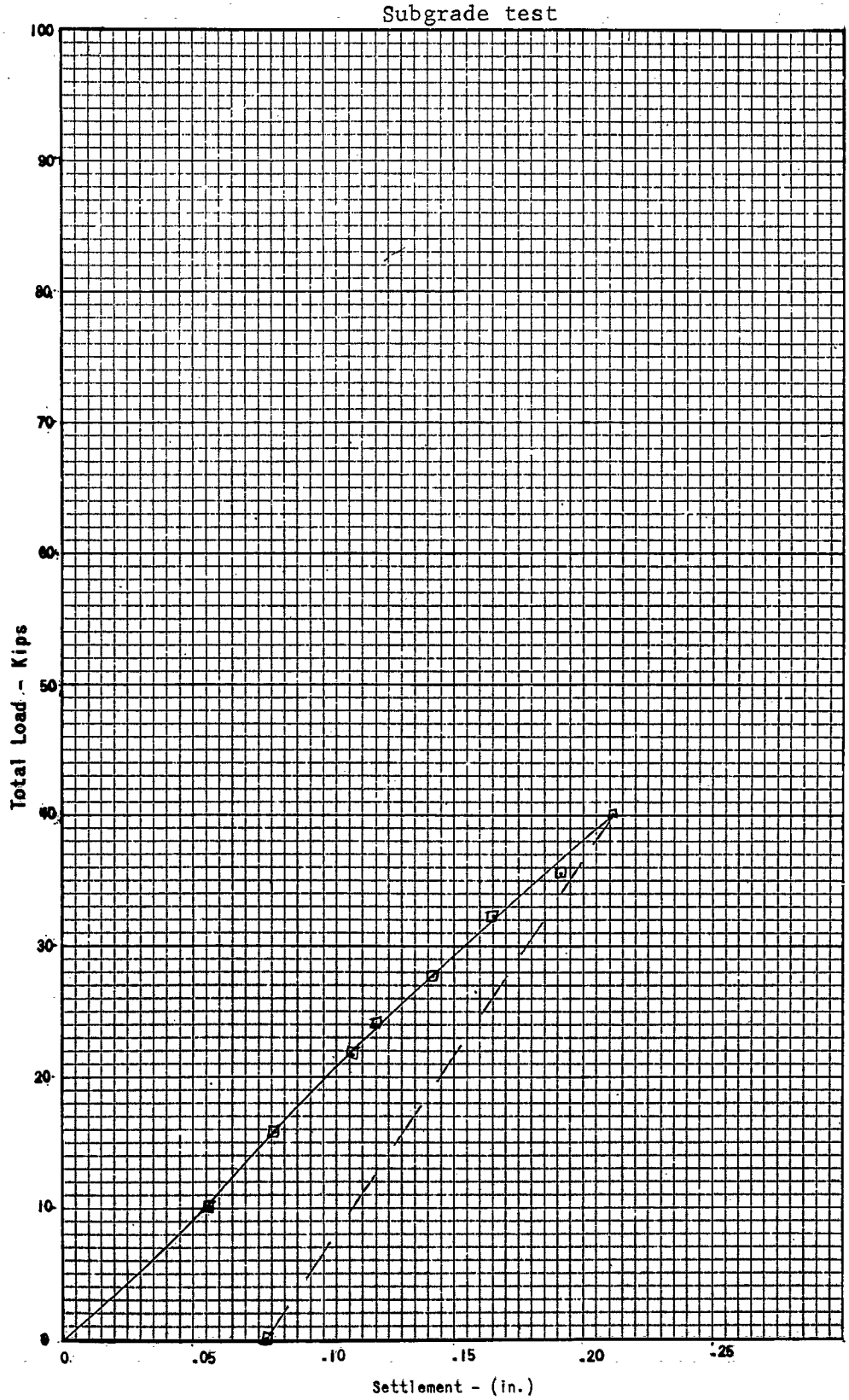
K = 440 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	6+00

Subgrade test

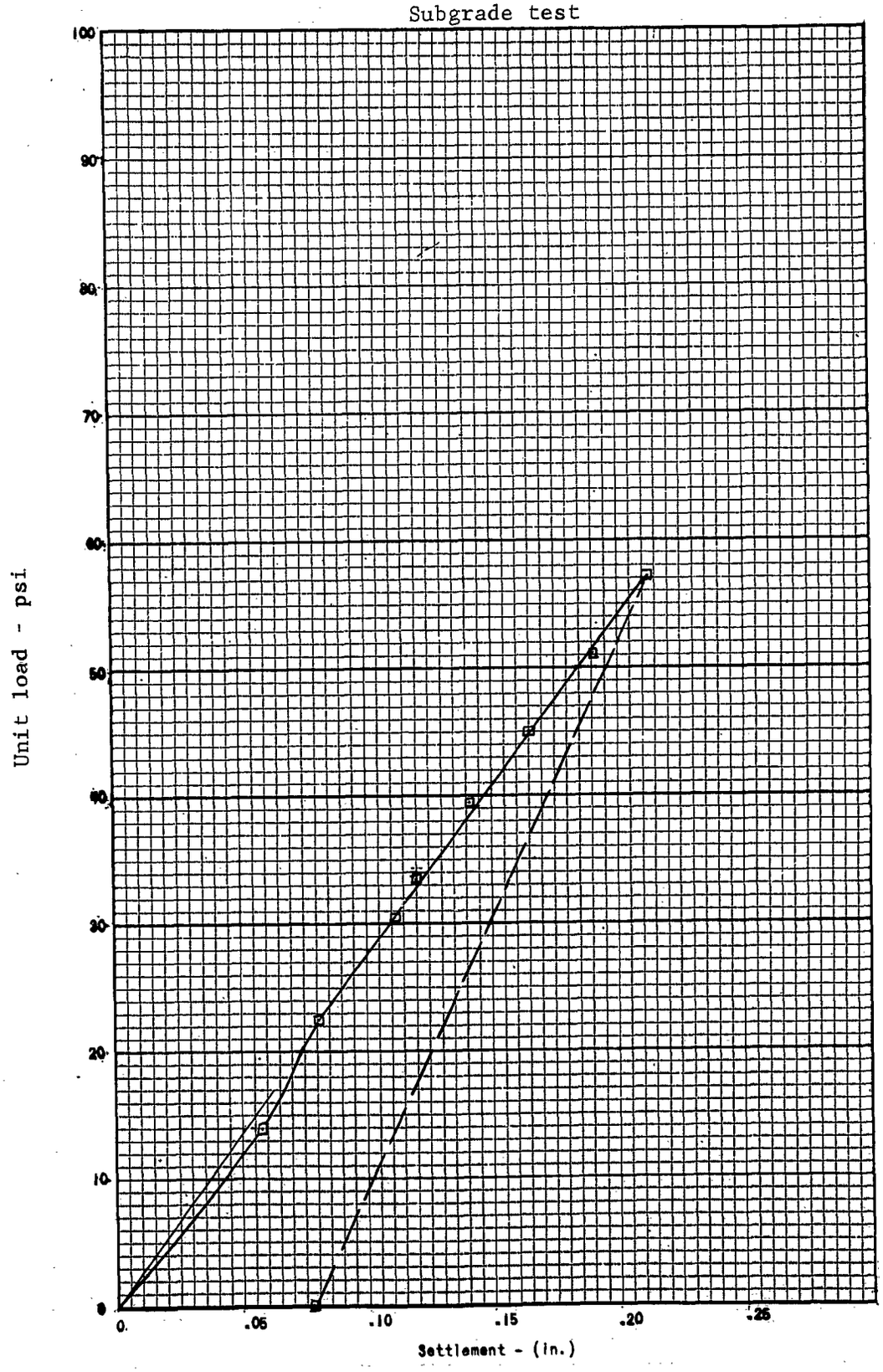


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	6+00

Subgrade test

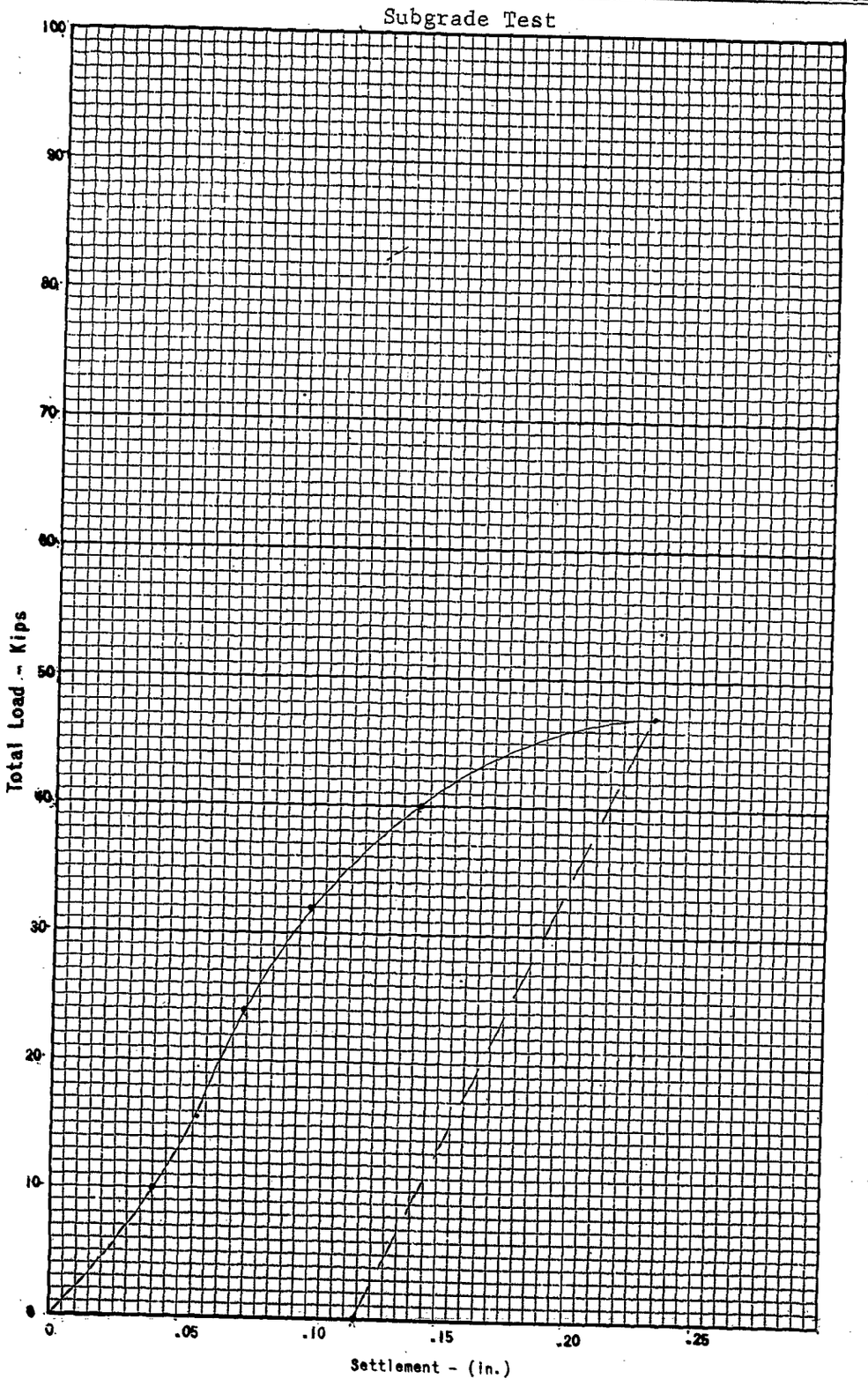


K = 270 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

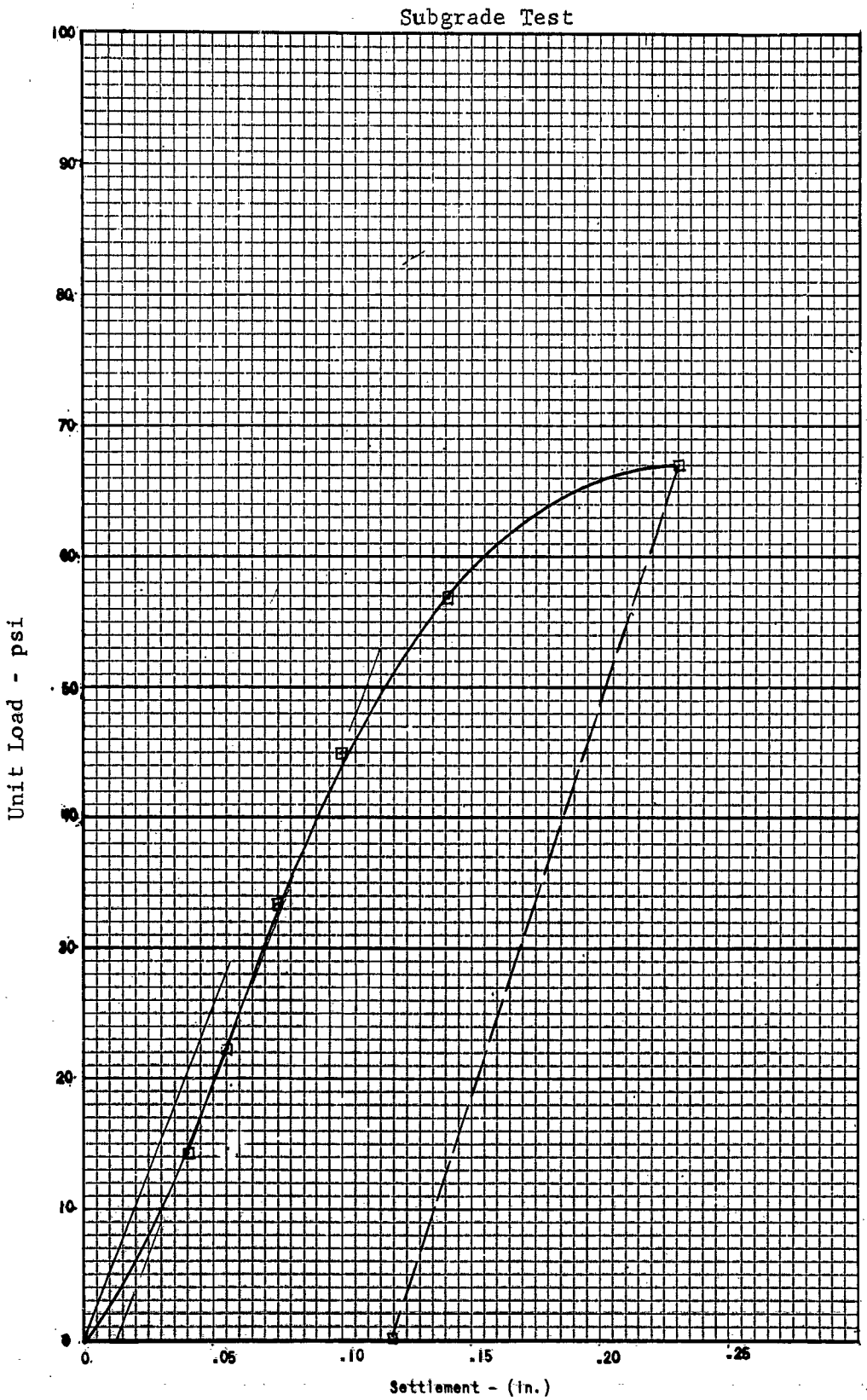
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	16+00



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

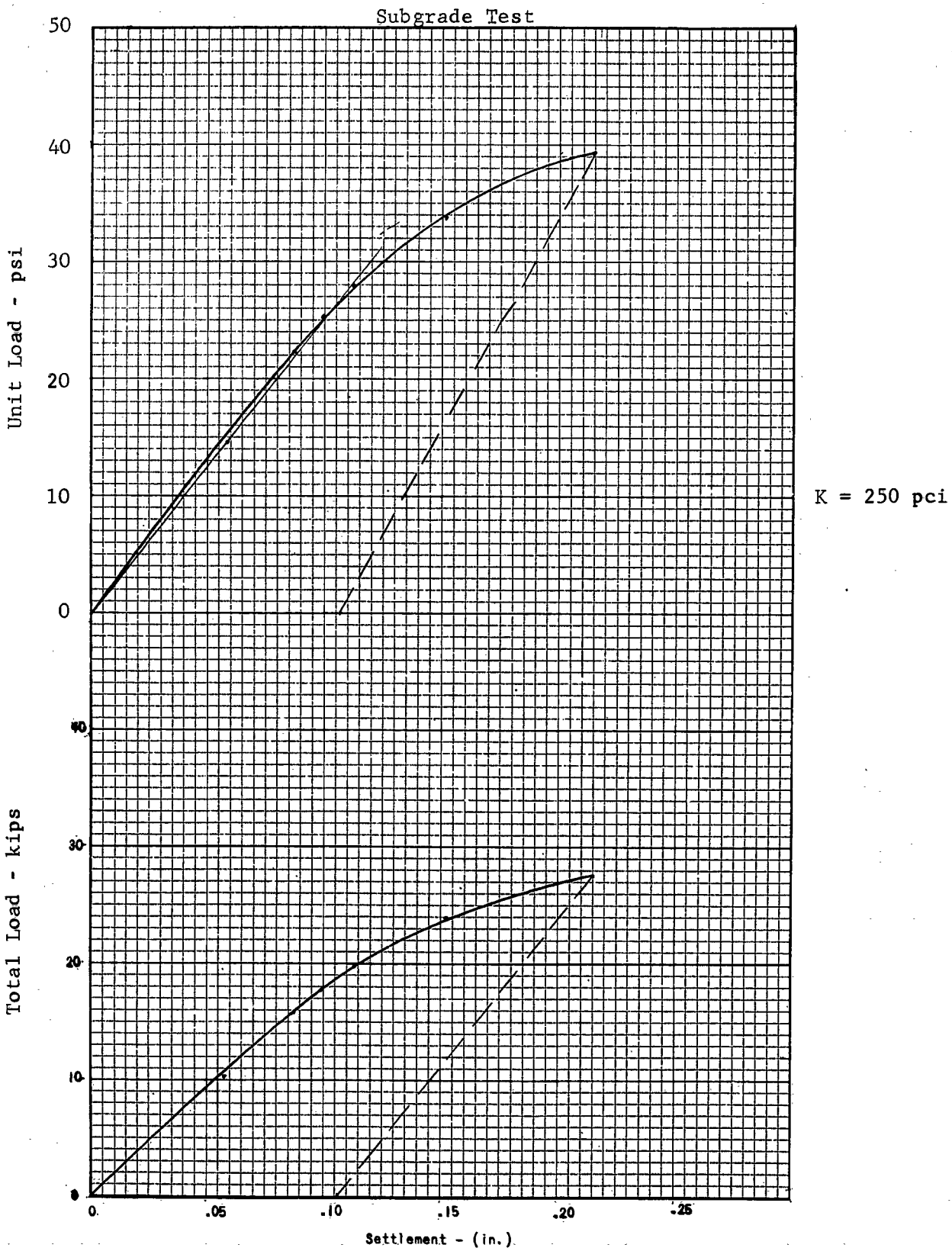
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	16+00



K = 510 pci

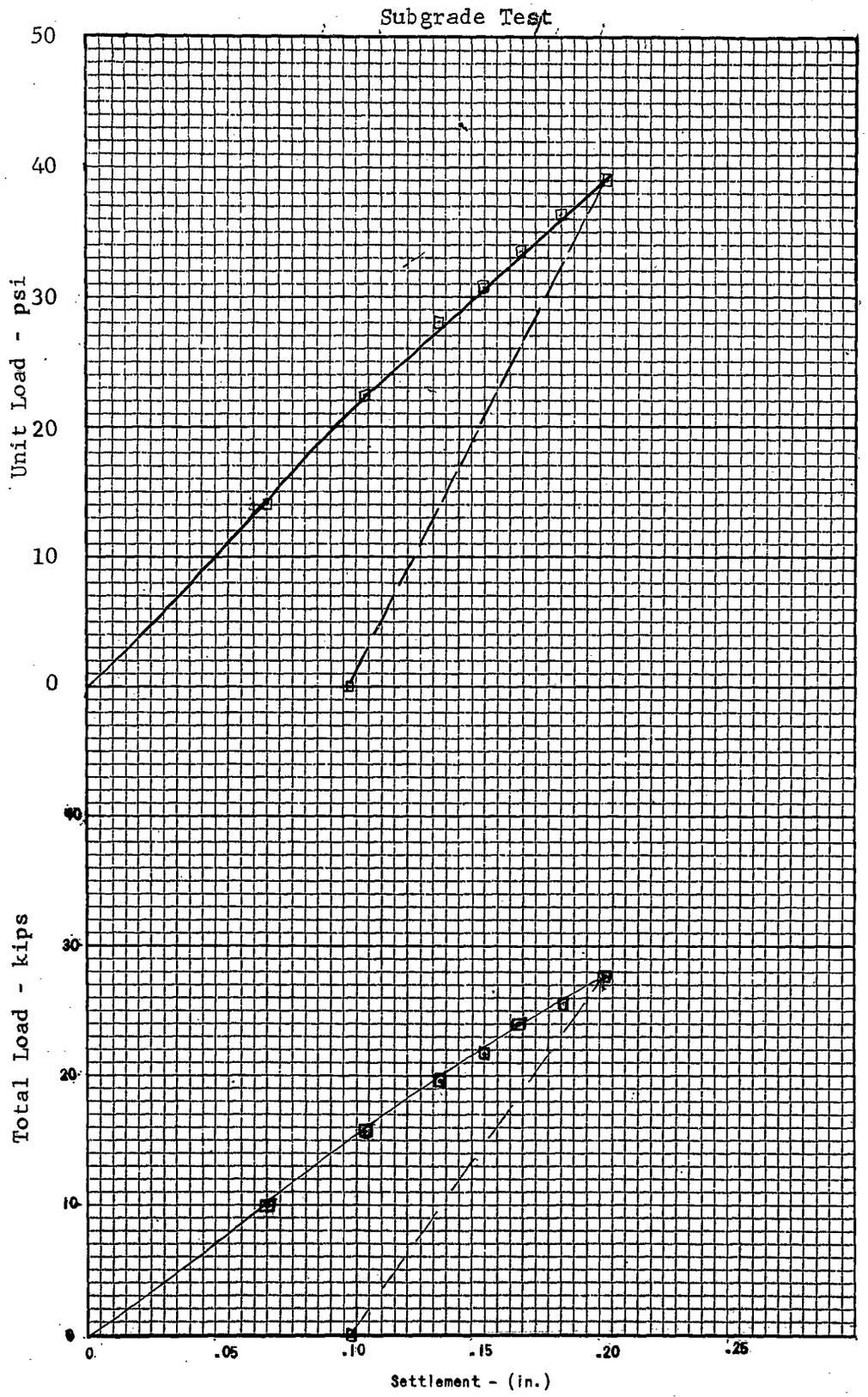
IIND NCEL 3960/20 (1-64) UNIT & TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	26+00



IIND NCEL 3960/20 (1-64) UNIT & TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	36+00



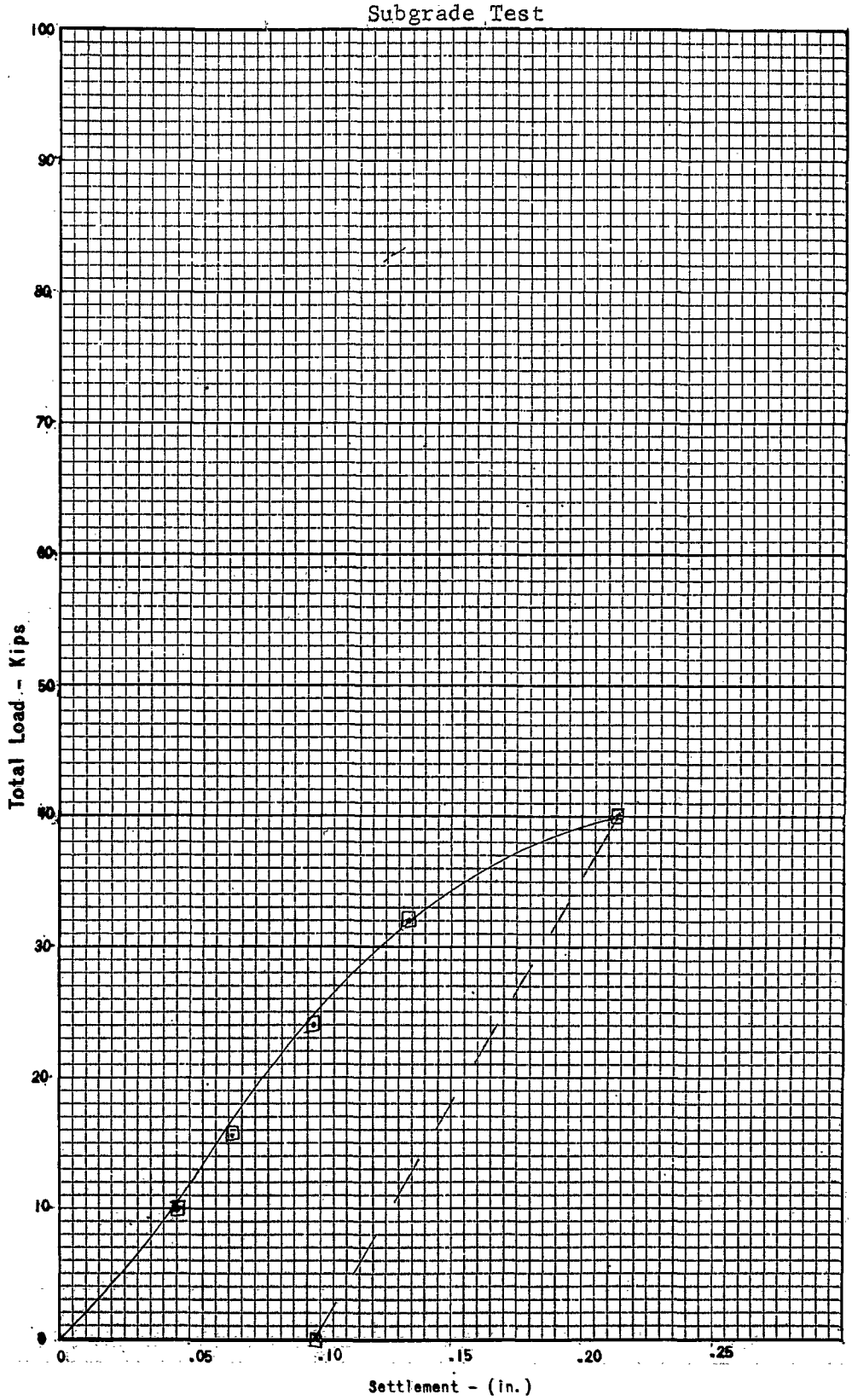
K = 200 pci

1 IND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	46+00

Subgrade Test

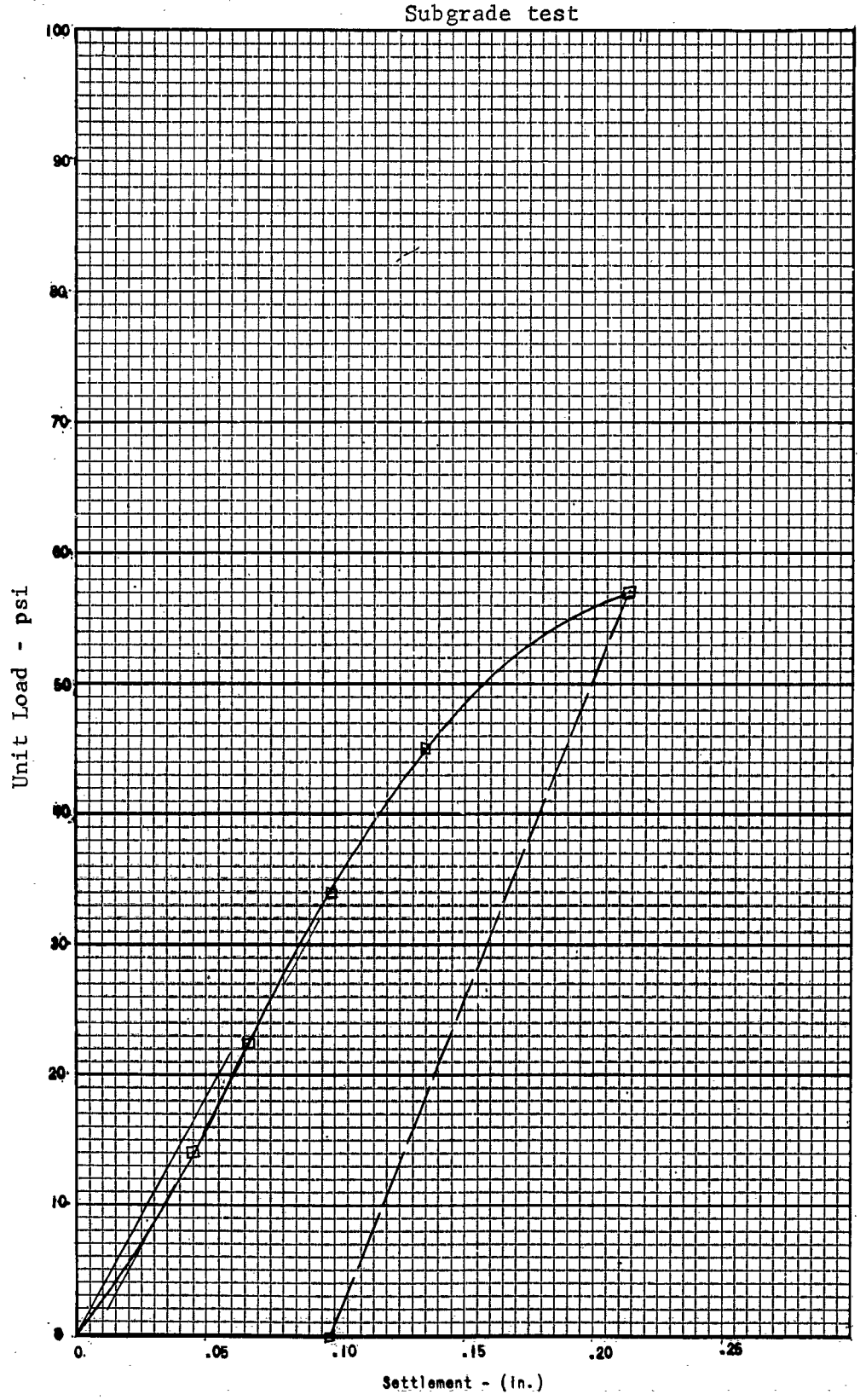


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	46+00

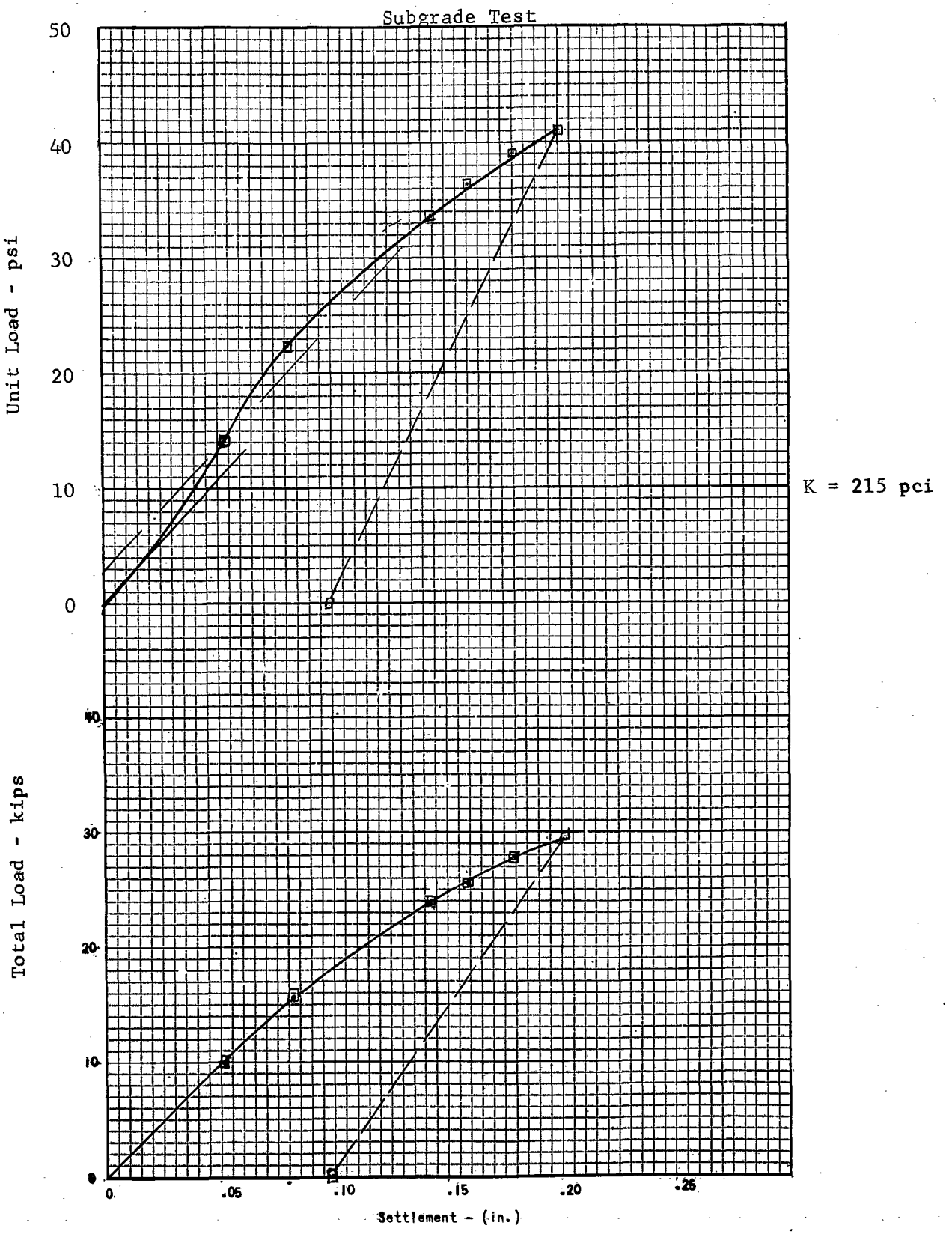
Subgrade test



K = 365 pci

IIND NCEL 3960/20 (1-64) UNIT & TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 08-26	56+00

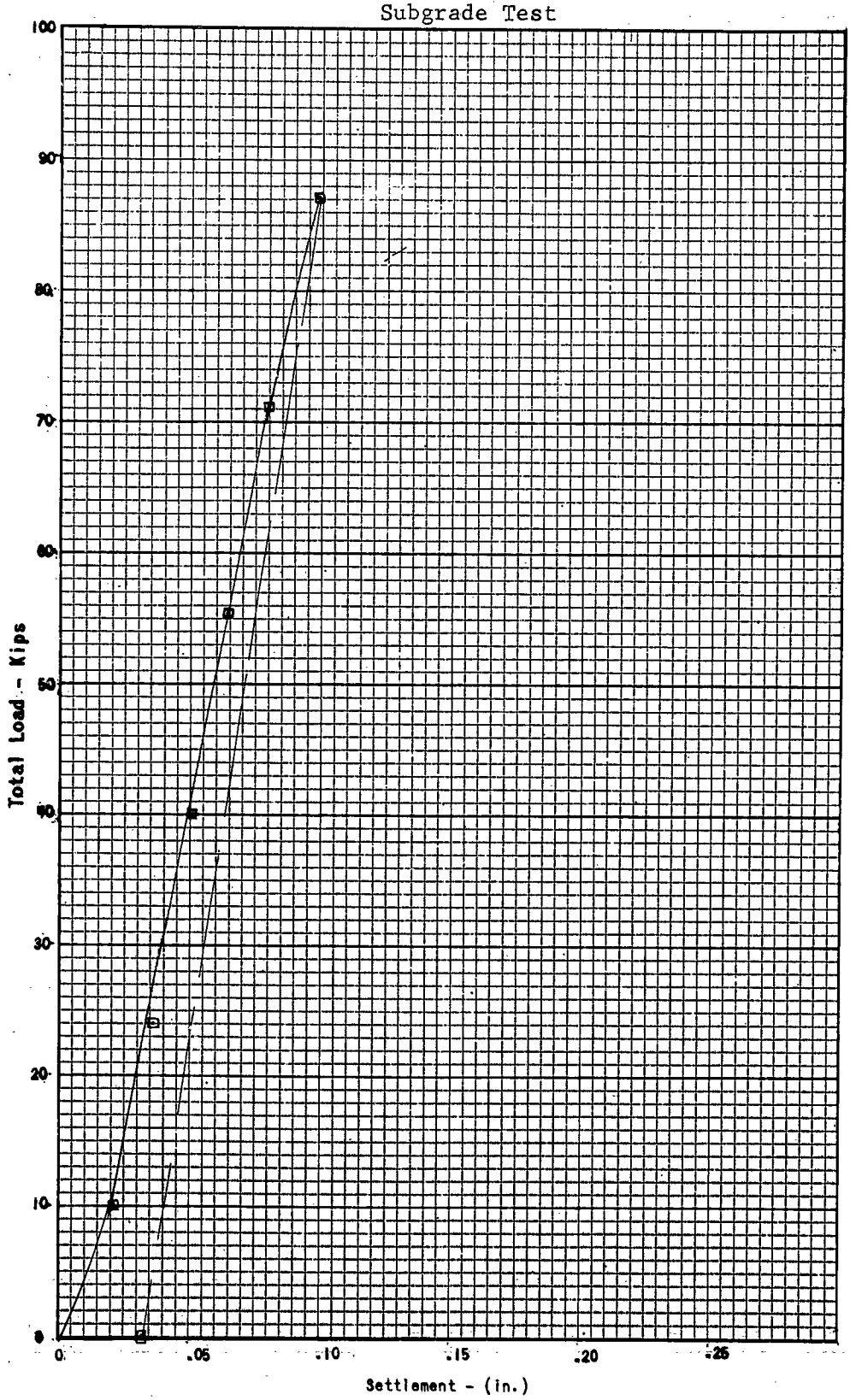


IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

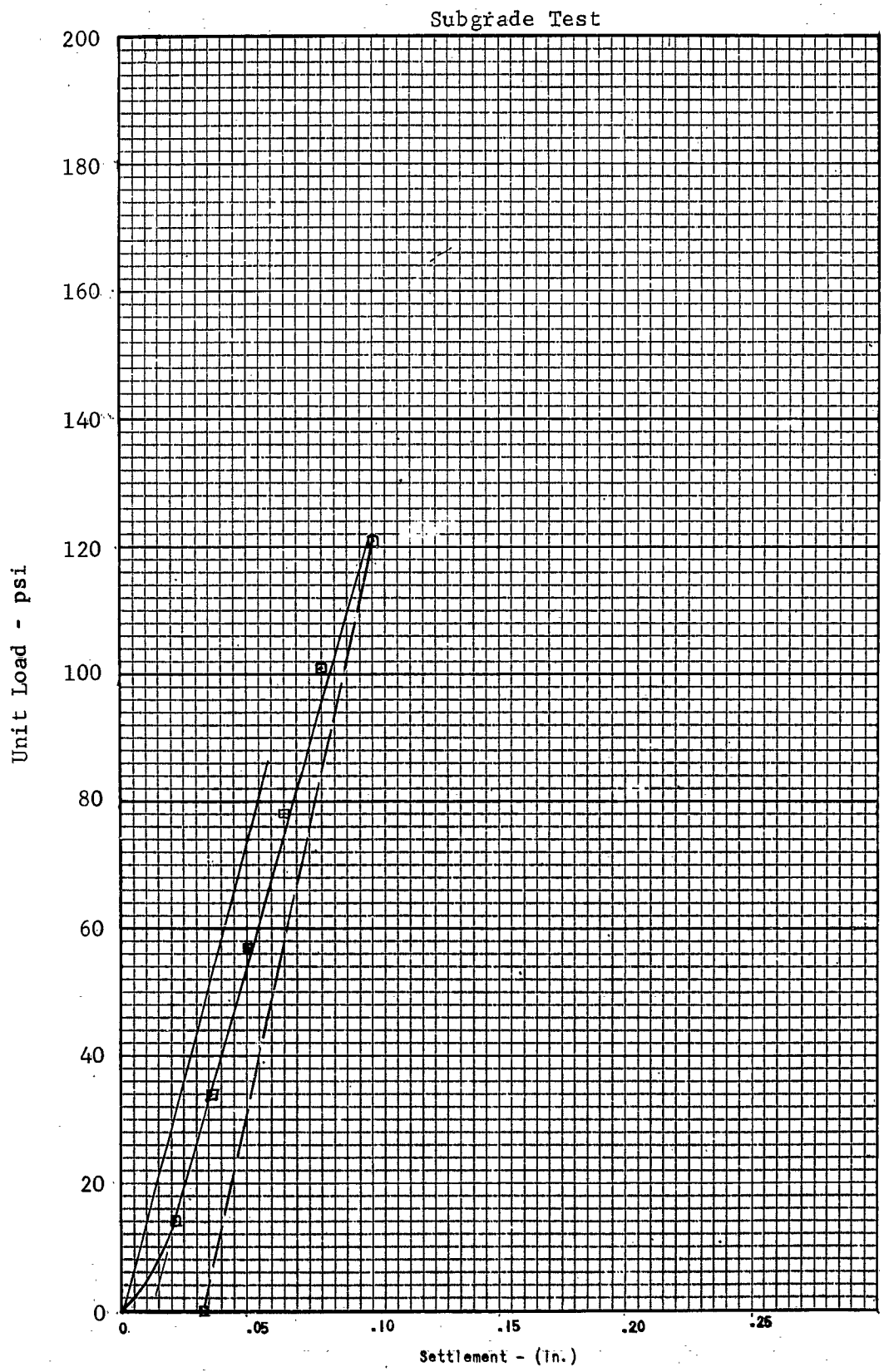
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	15+50

Subgrade Test



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03L-21R	15+50



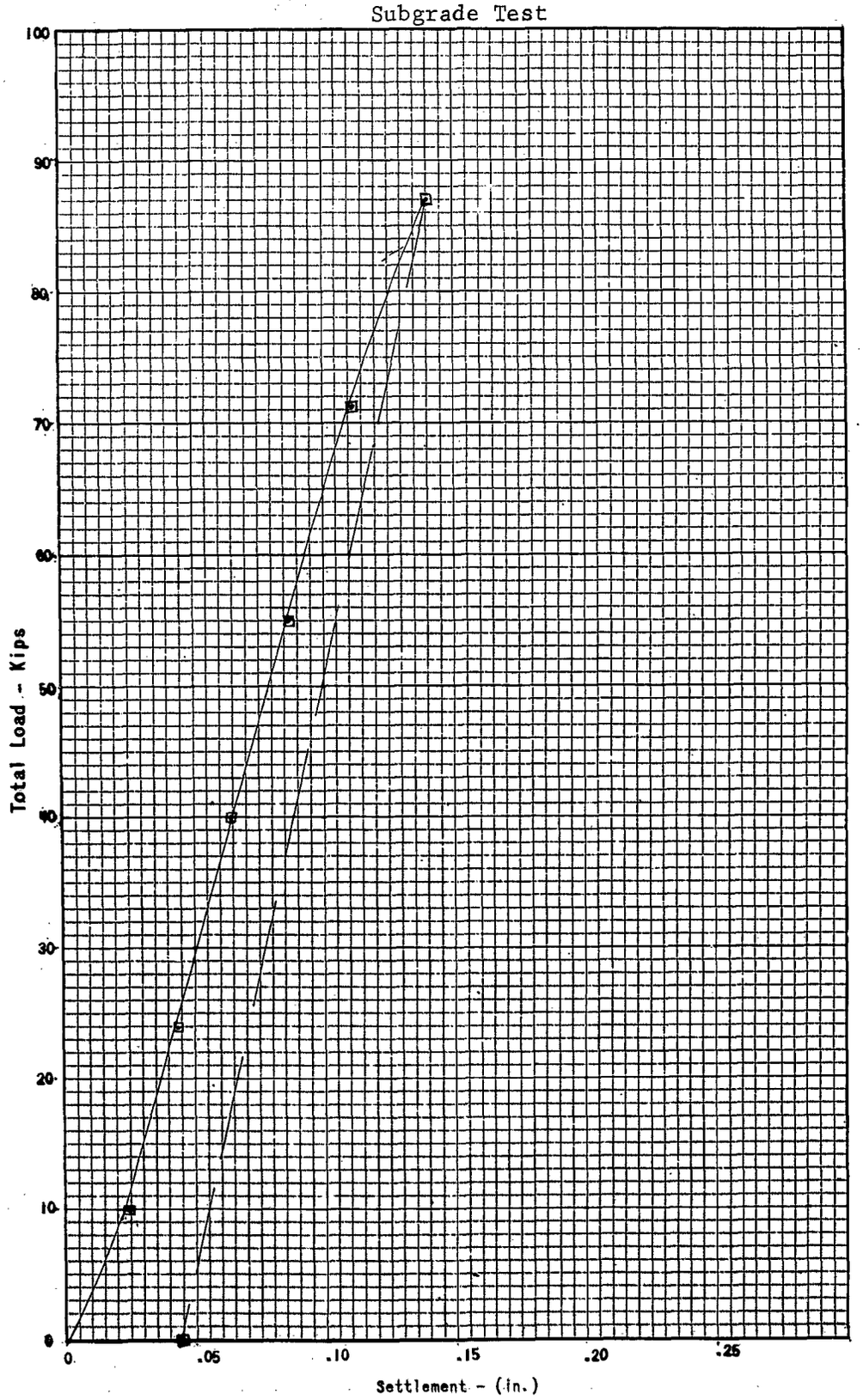
K = 1460 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

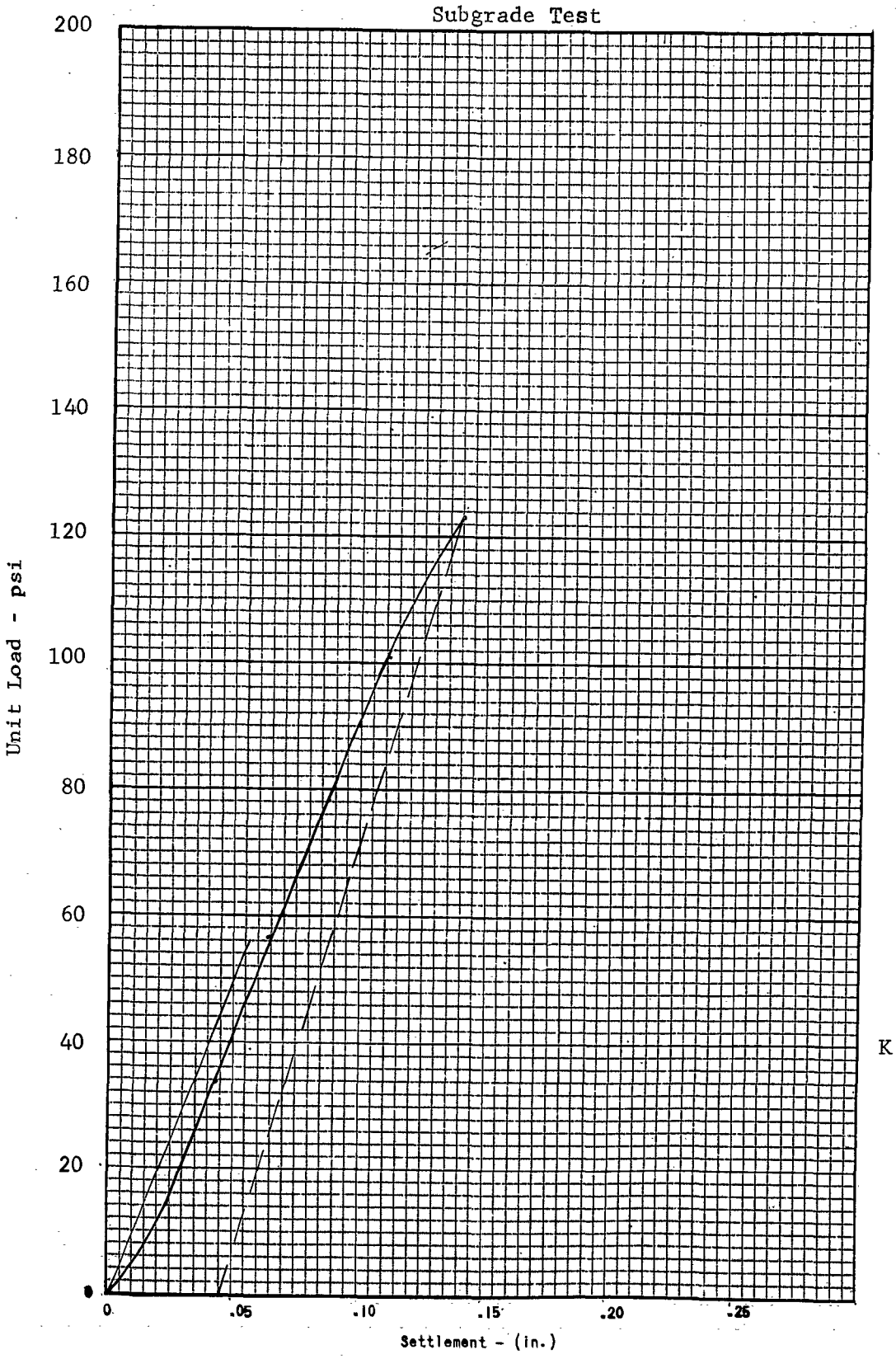
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	25+50

Subgrade Test



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	25+50



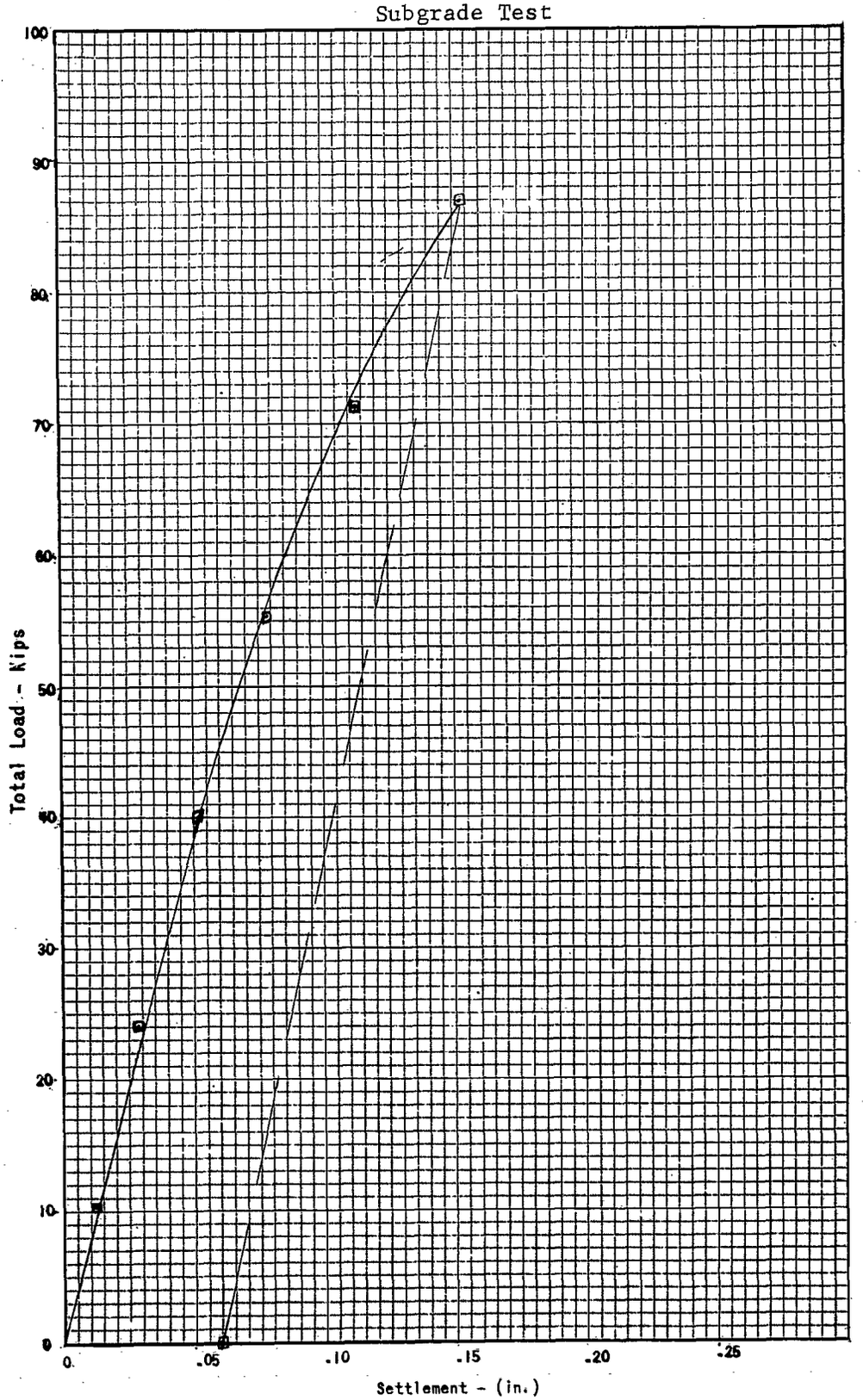
K = 1000 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	35+50

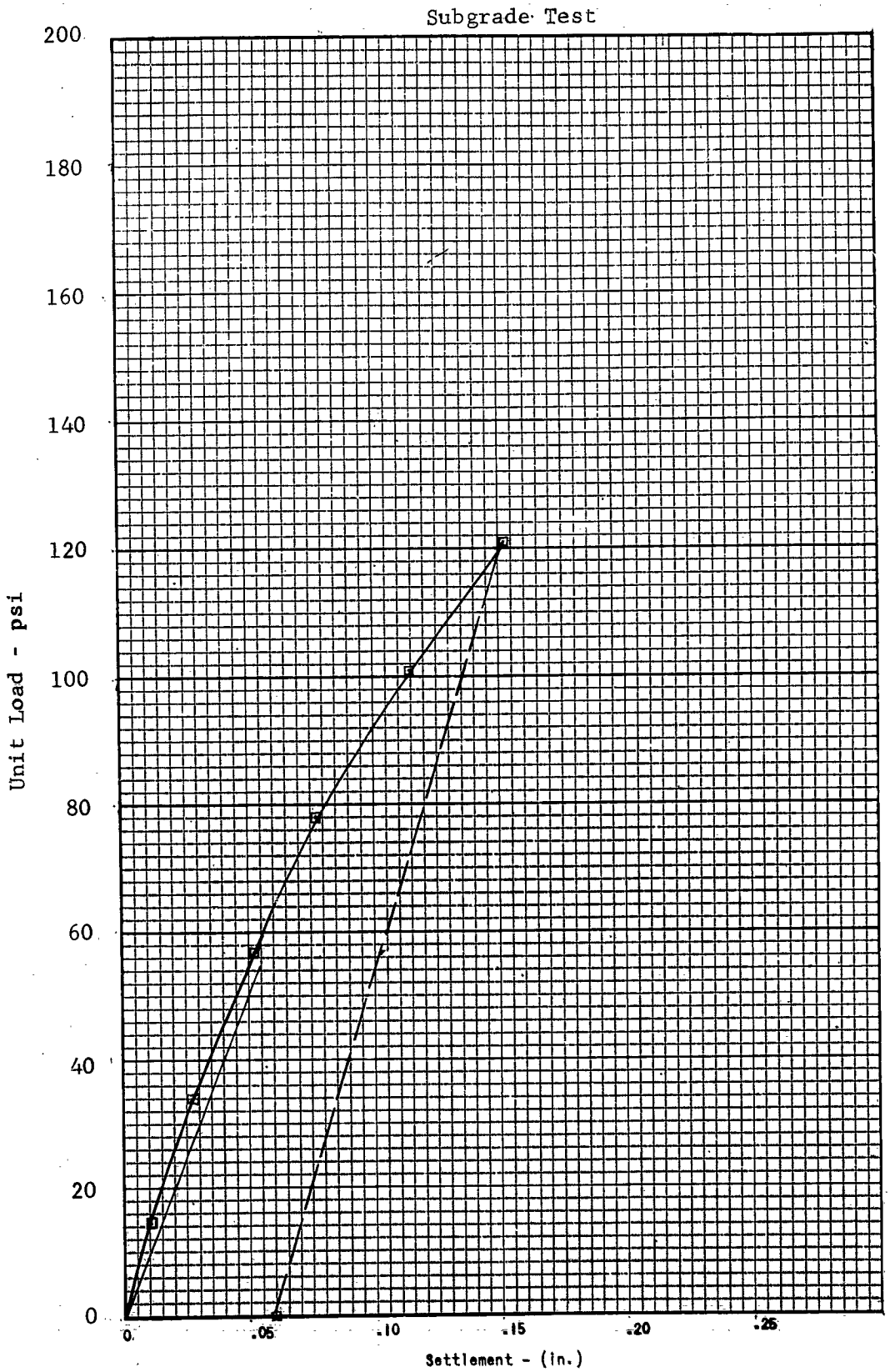
Subgrade Test



IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	35+50

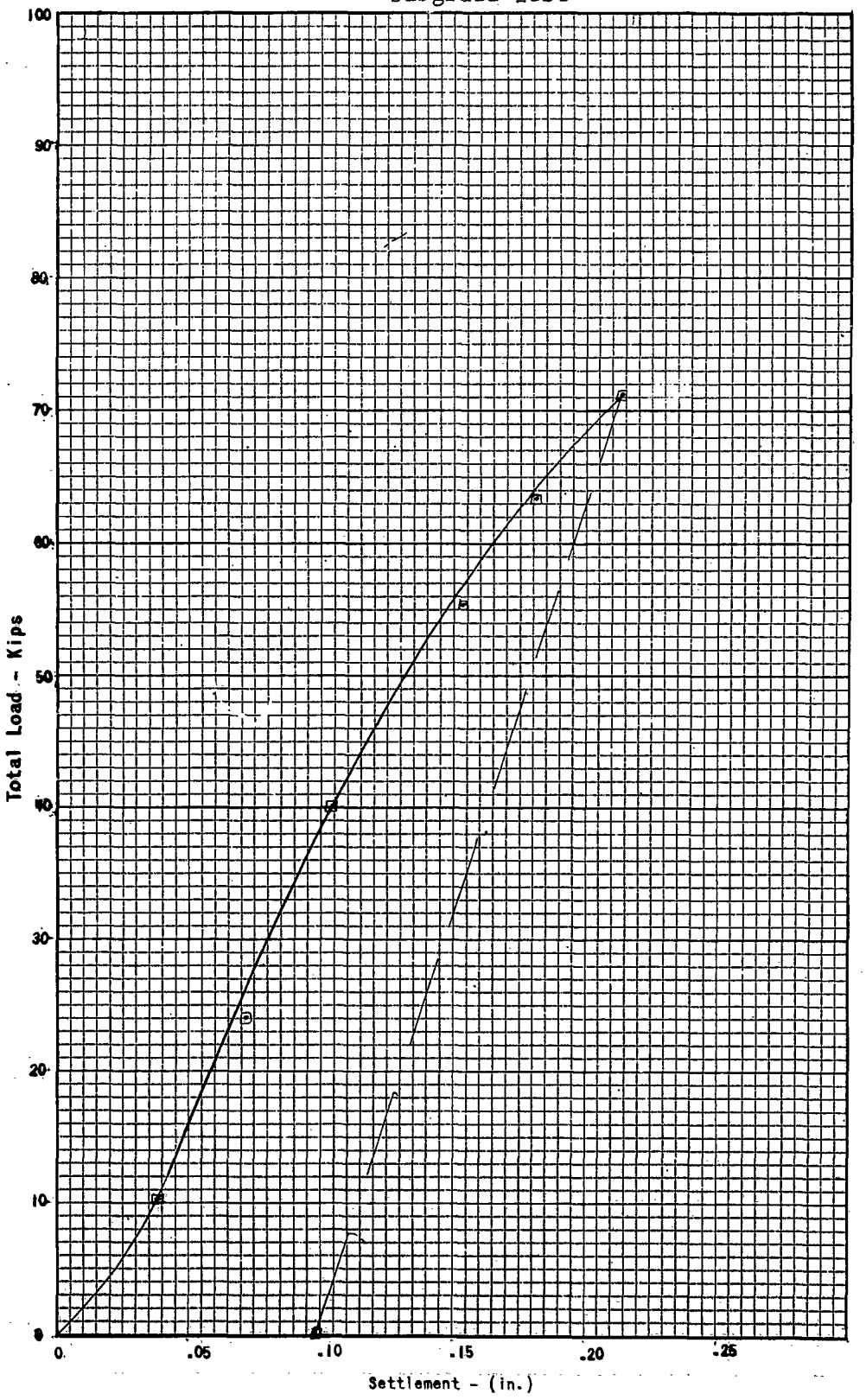


K = 1000 pci

IIND NCEL 3960/20 (1-64) TOTAL LOAD vs. DEFLECTION

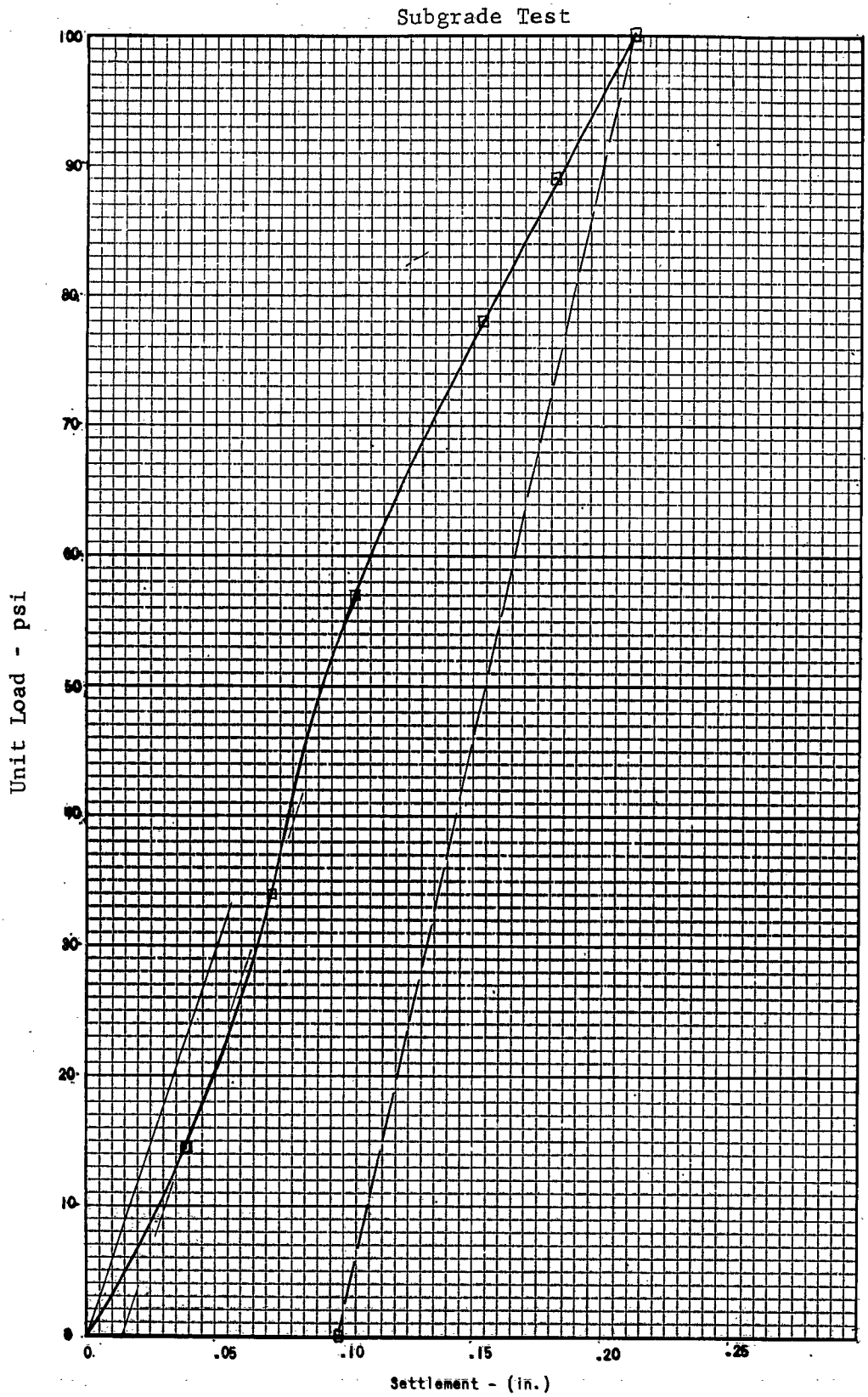
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	45+00

Subgrade Test



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	45+00



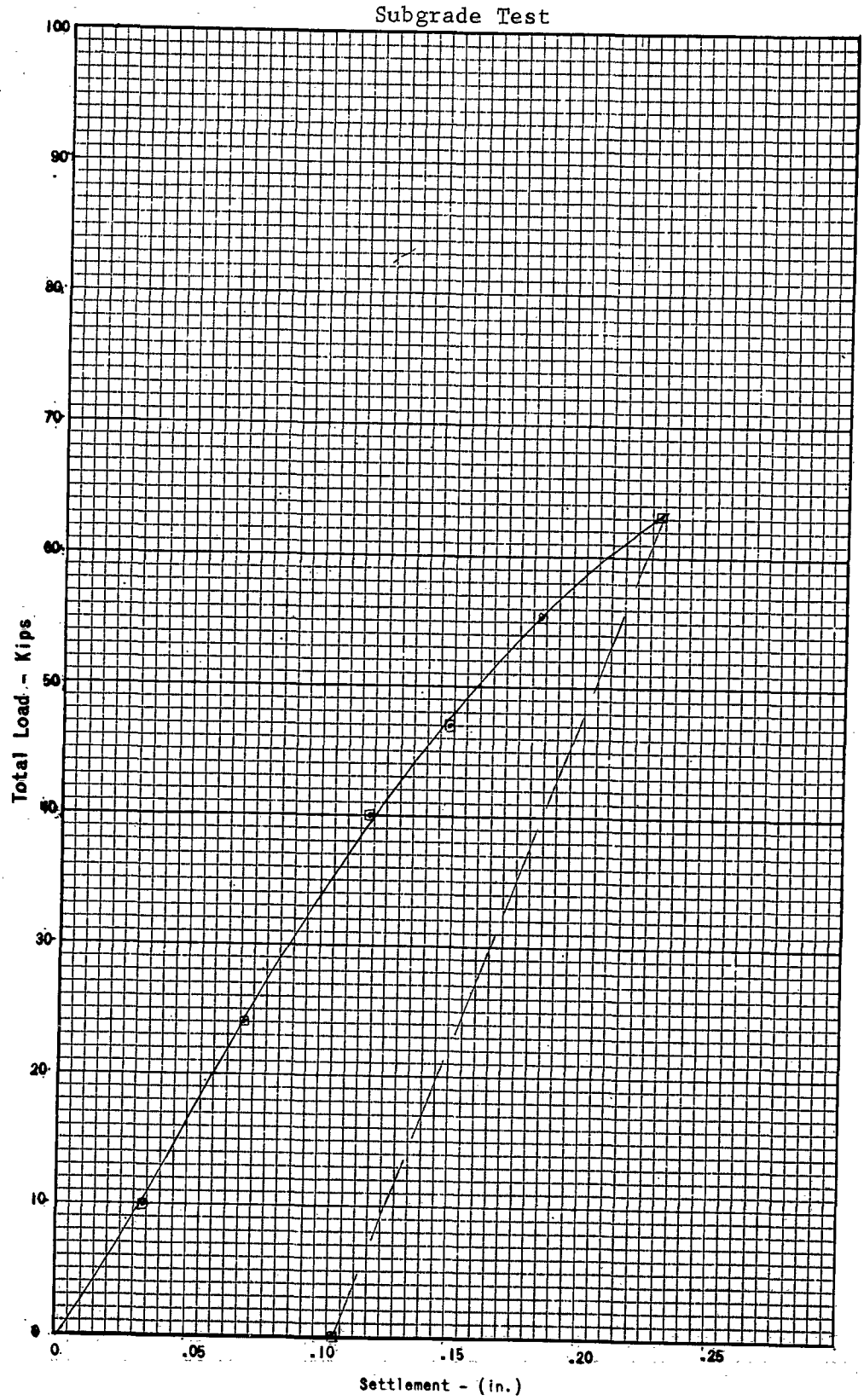
K = 590 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	55+00

Subgrade Test

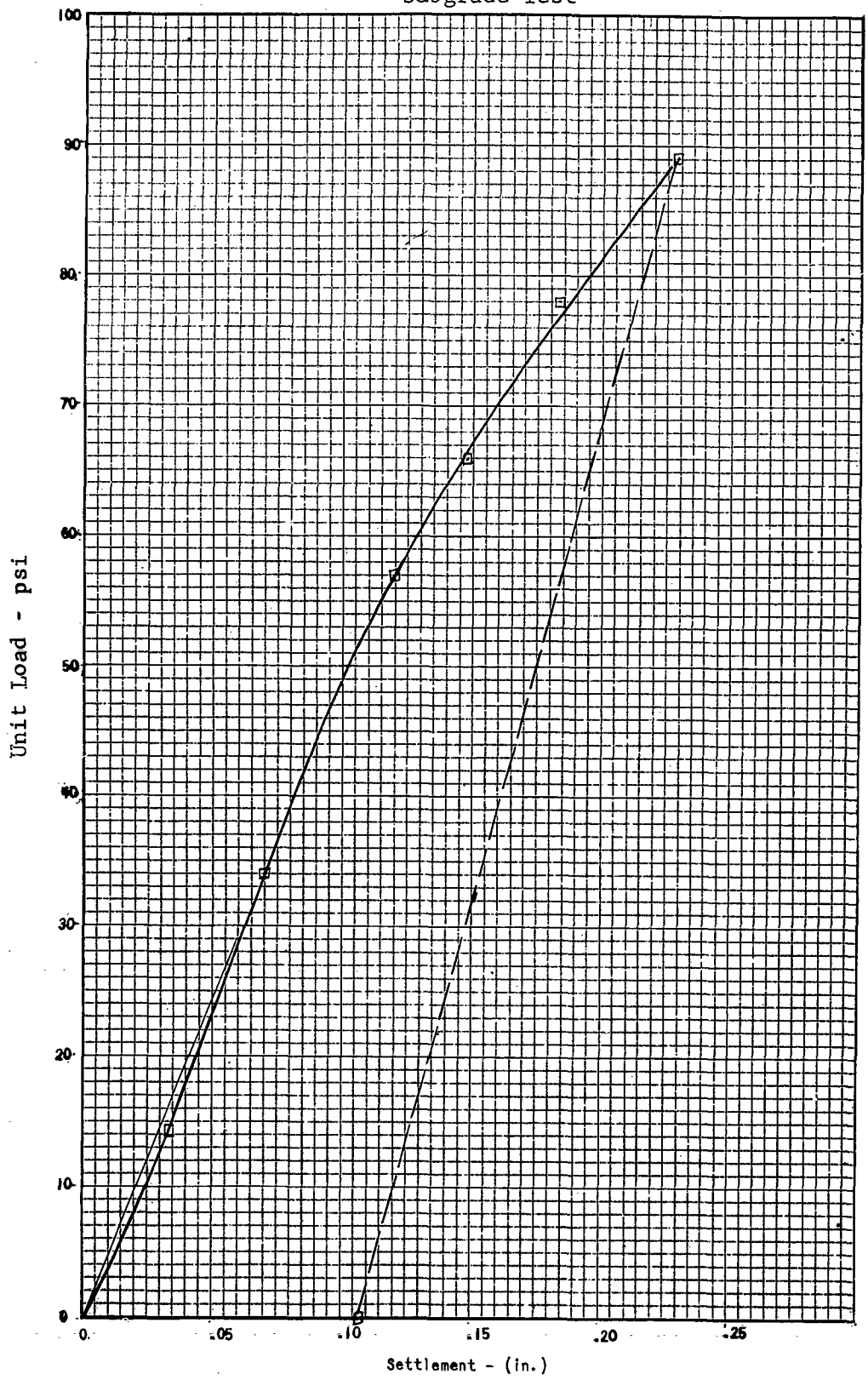


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	55+00

Subgrade Test



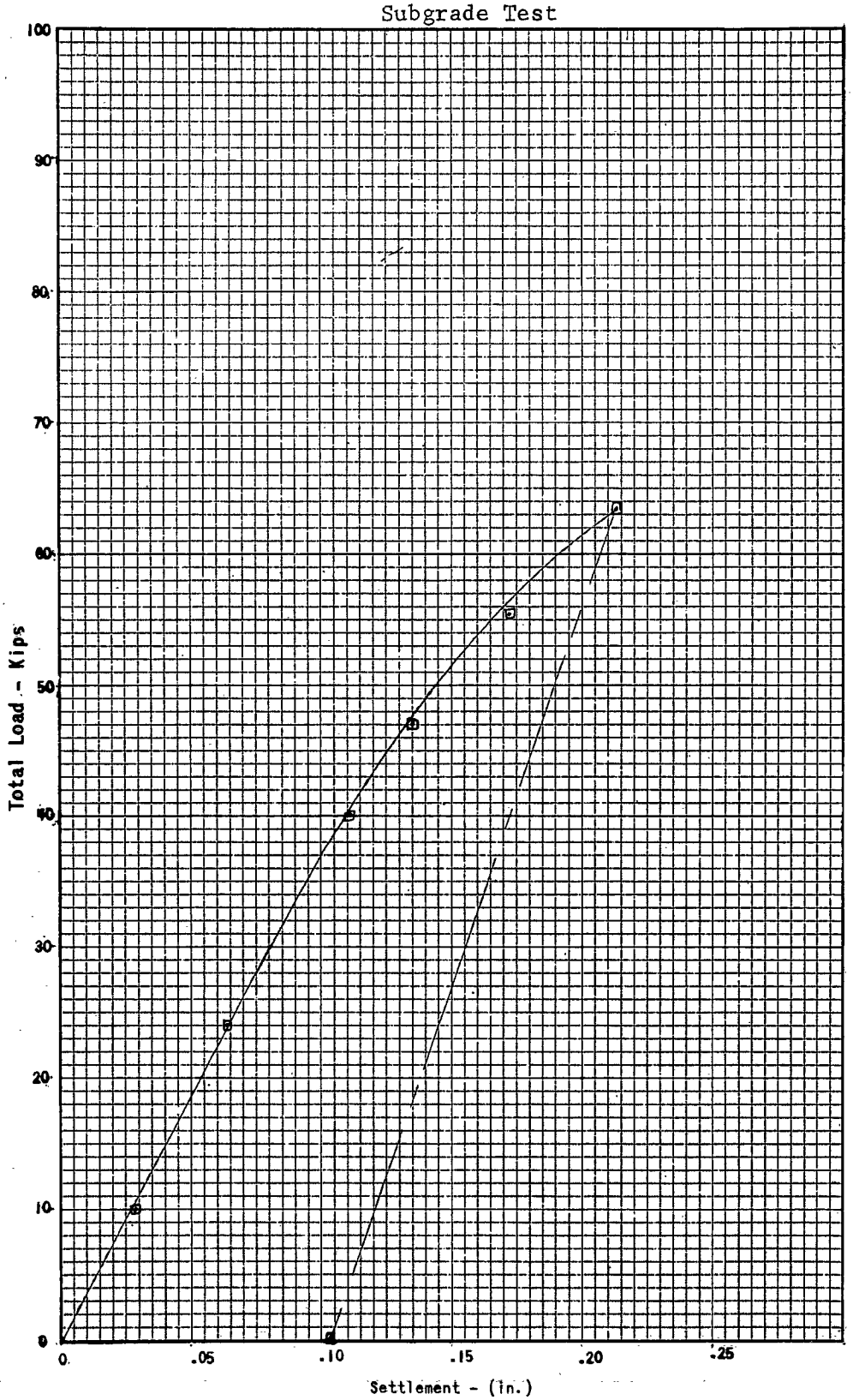
K = 490 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	65+00

Subgrade Test

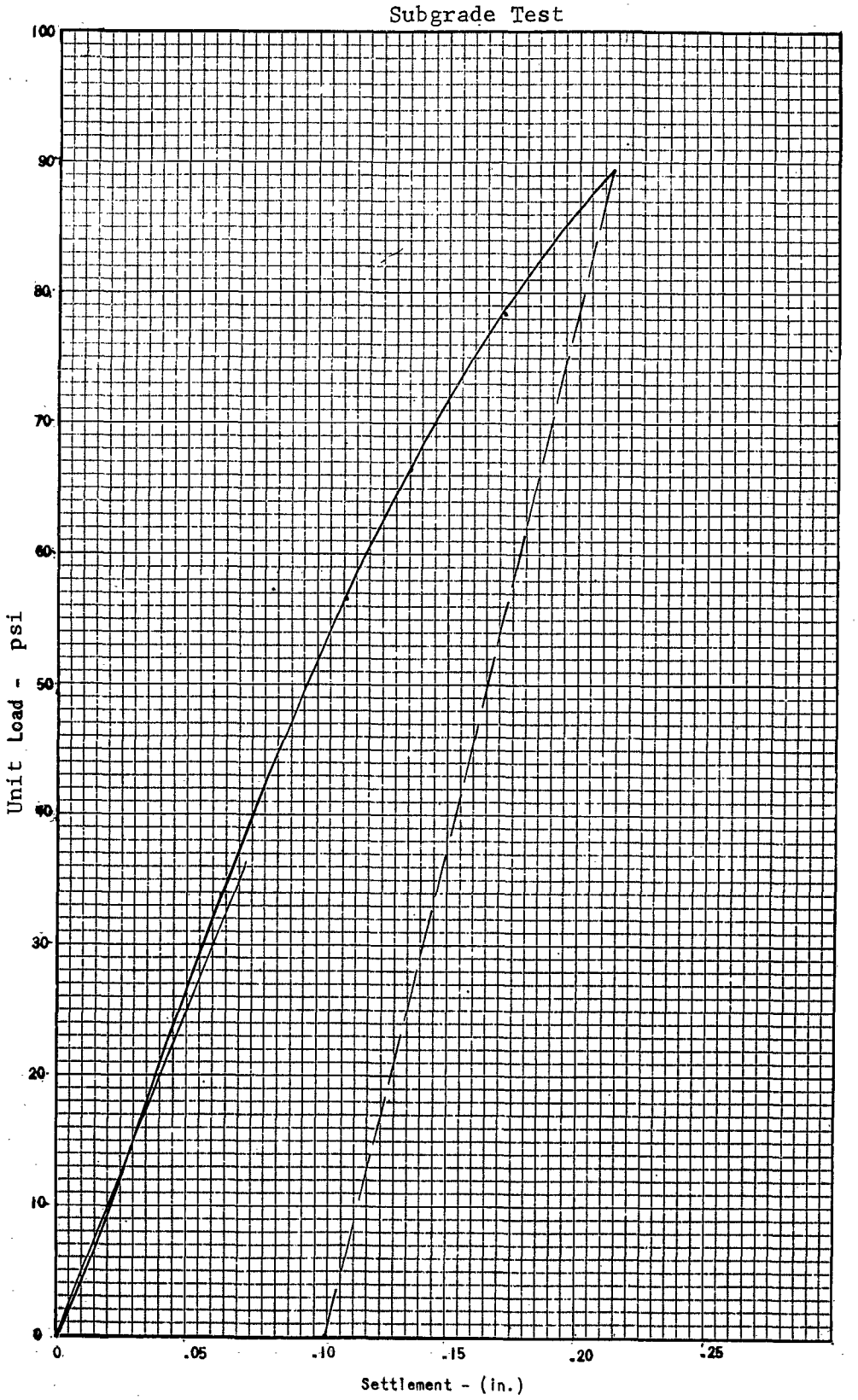


1IND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	65+00

Subgrade Test



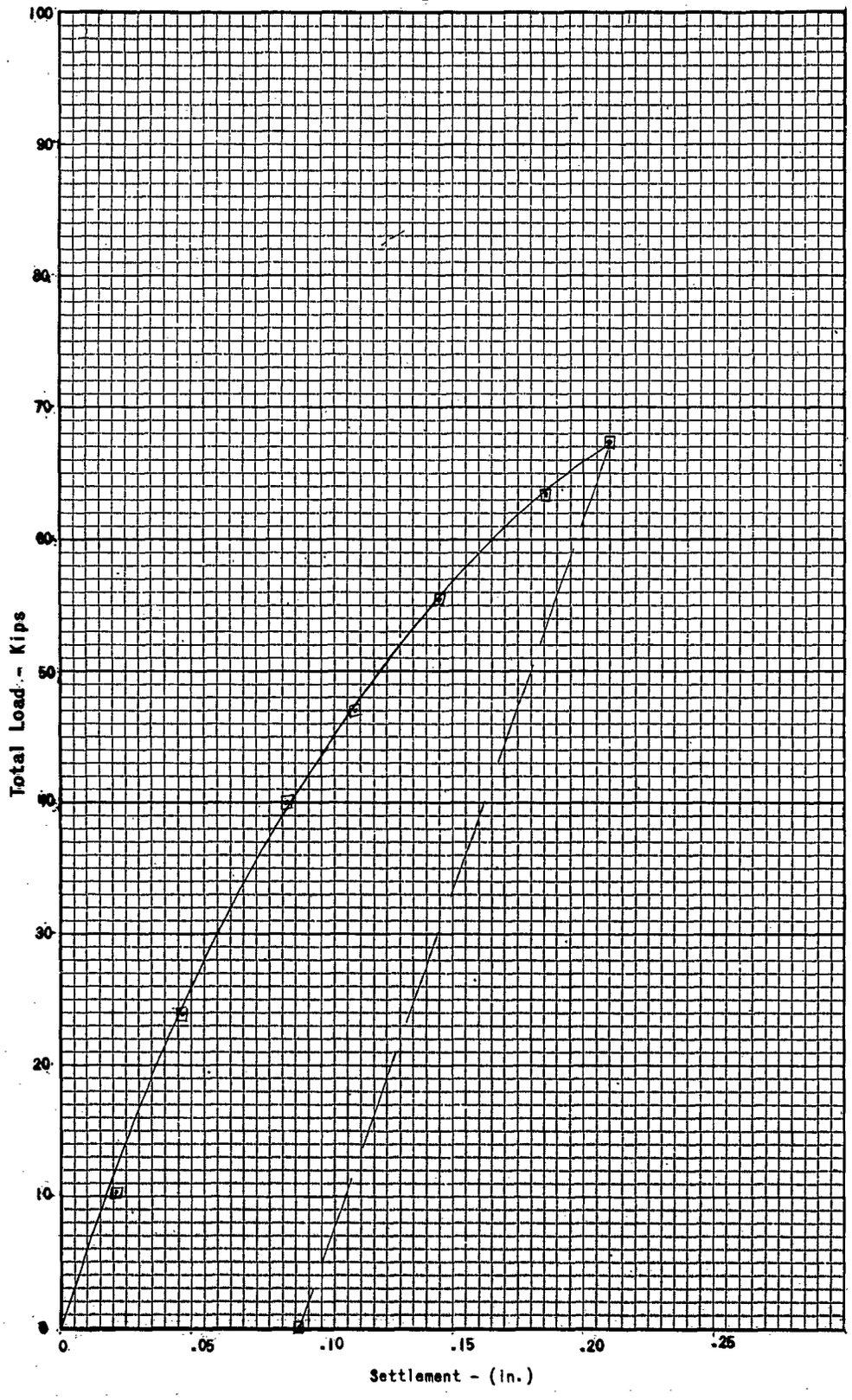
K = 500 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	75+00

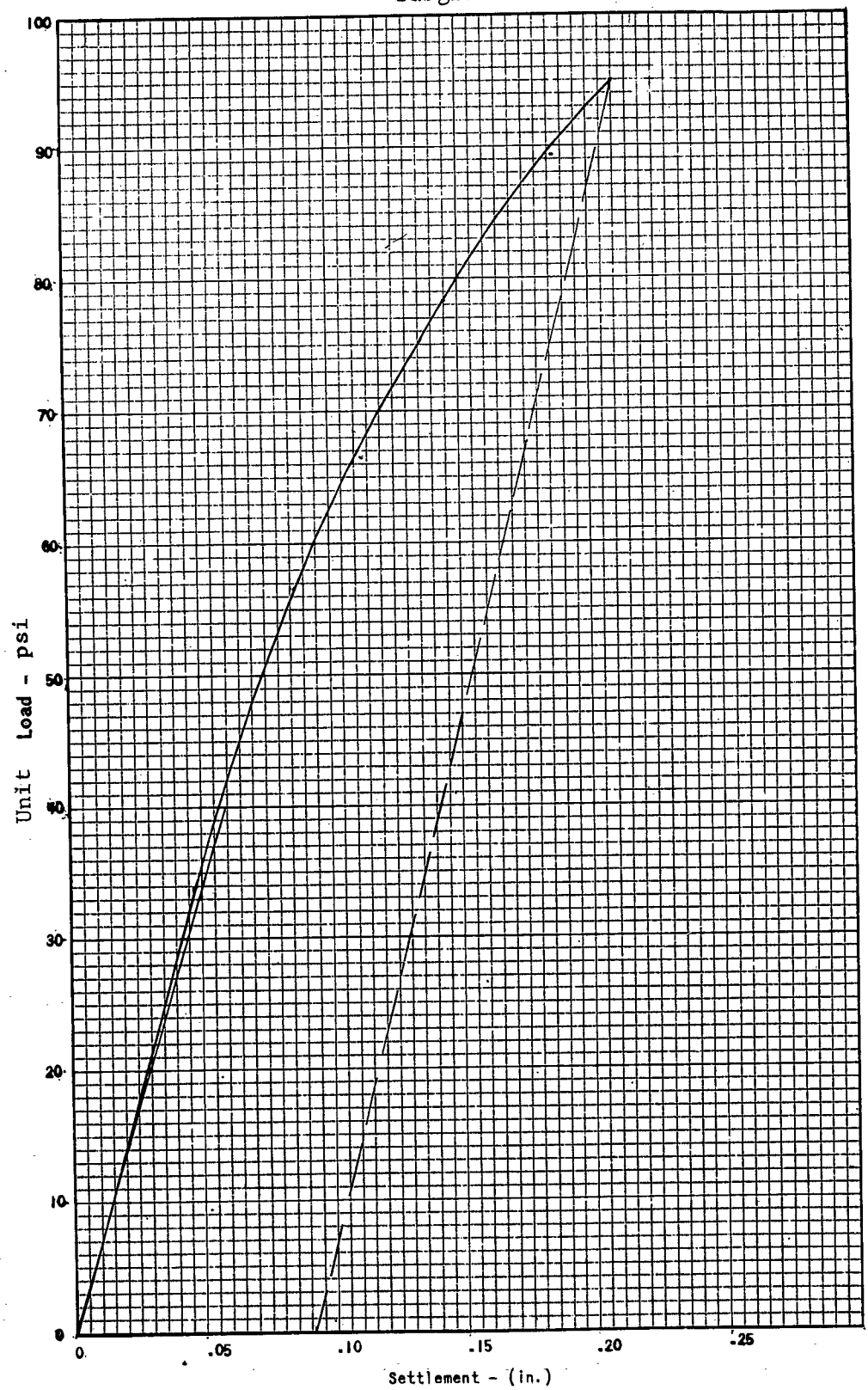
Subgrade Tests



IIND NCEL 3960/20 (1-64) UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	75+00

Subgrade Test

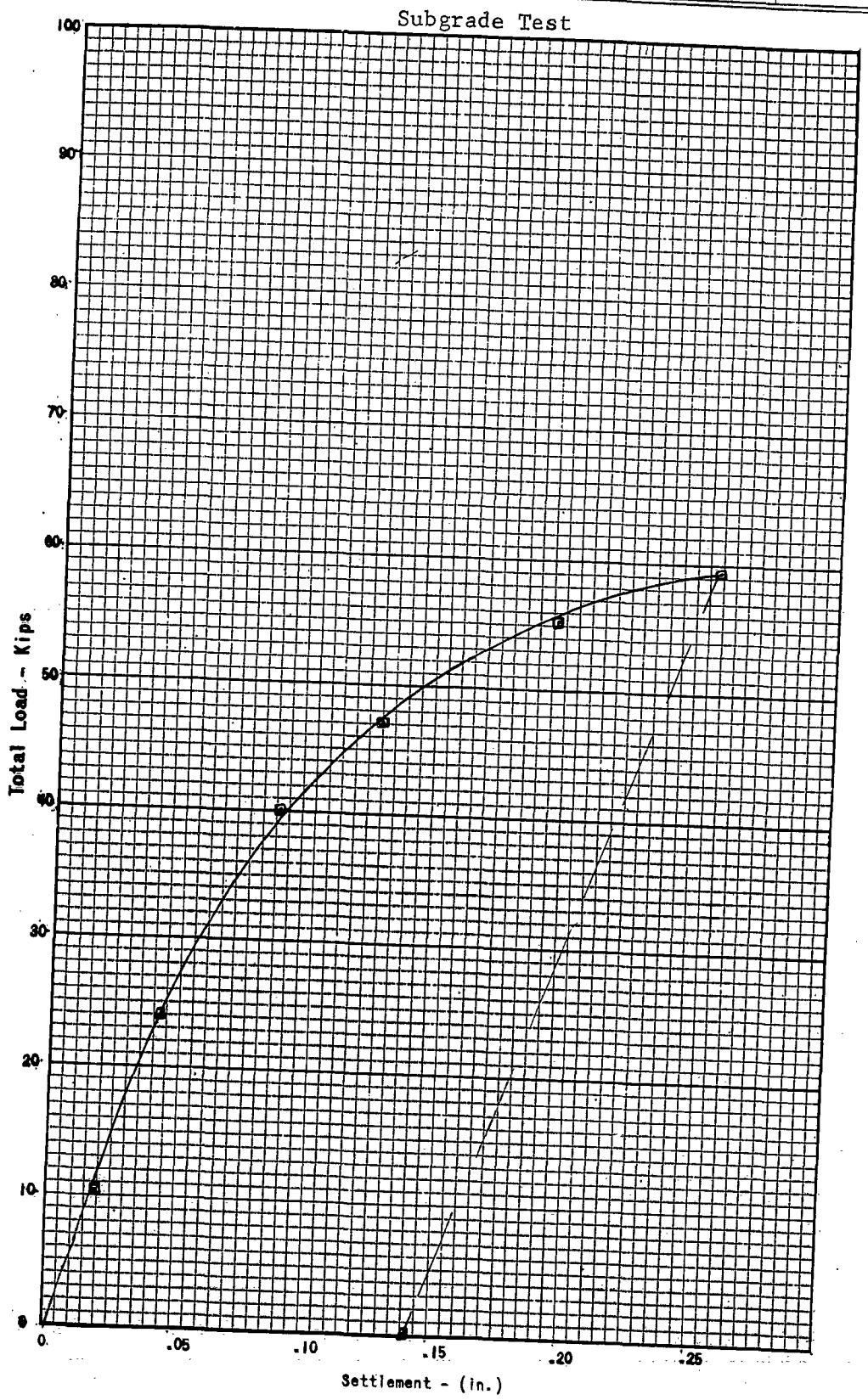


K = 675 pci

IIND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	85+00

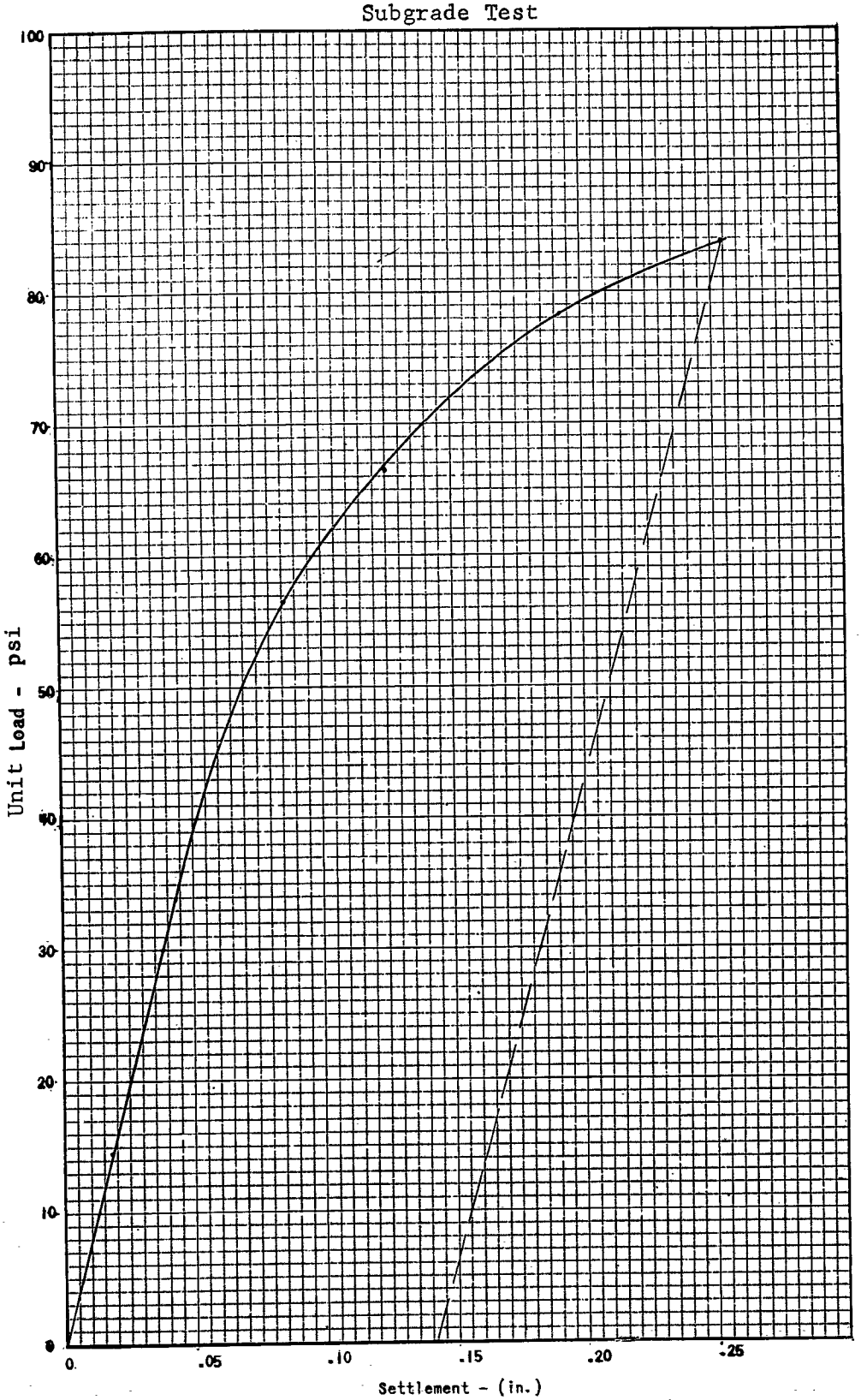


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	85+00

Subgrade Test



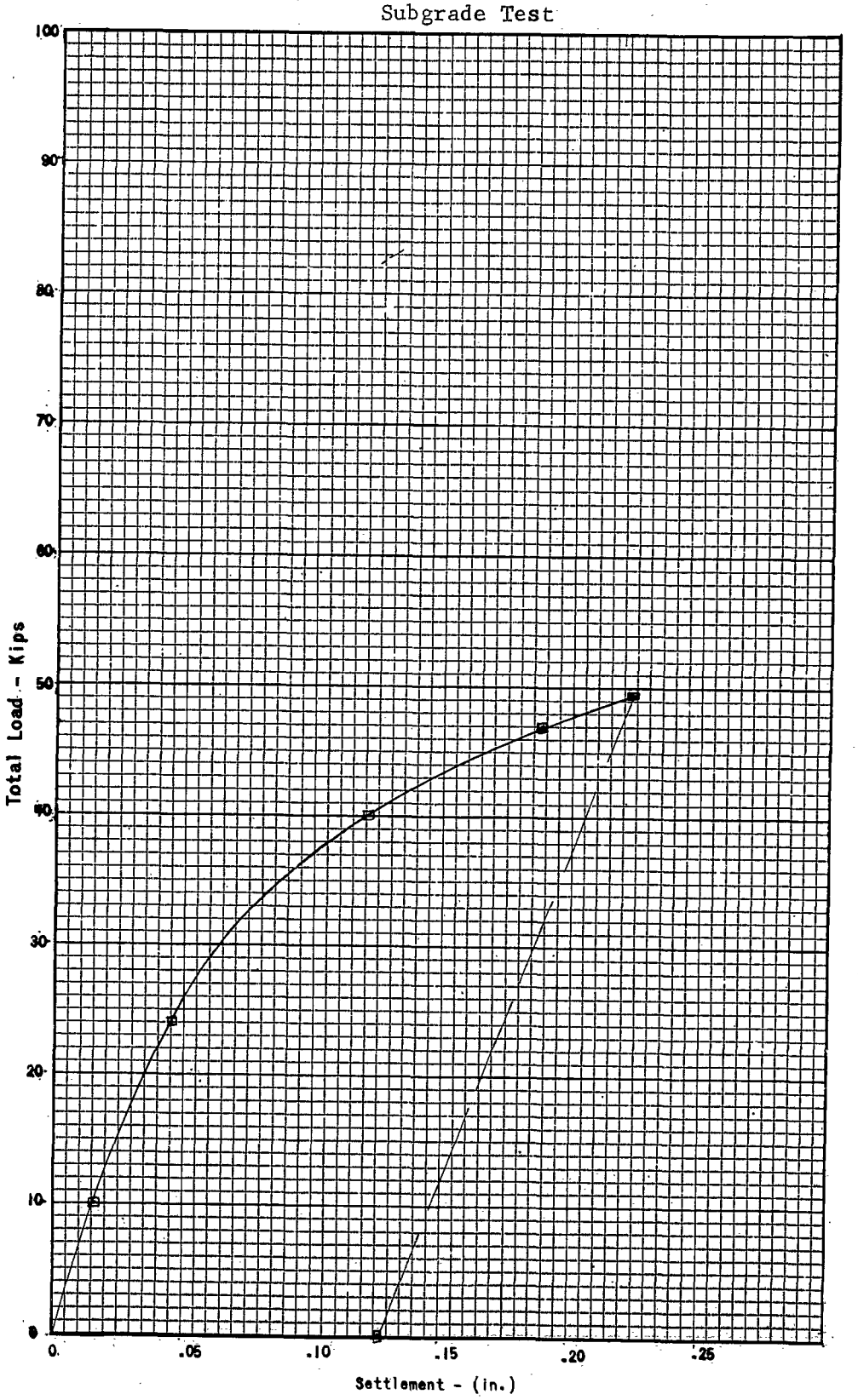
K = 780 pci

1 IND NCEL 3960/20 (1-64)

TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	93+50

Subgrade Test

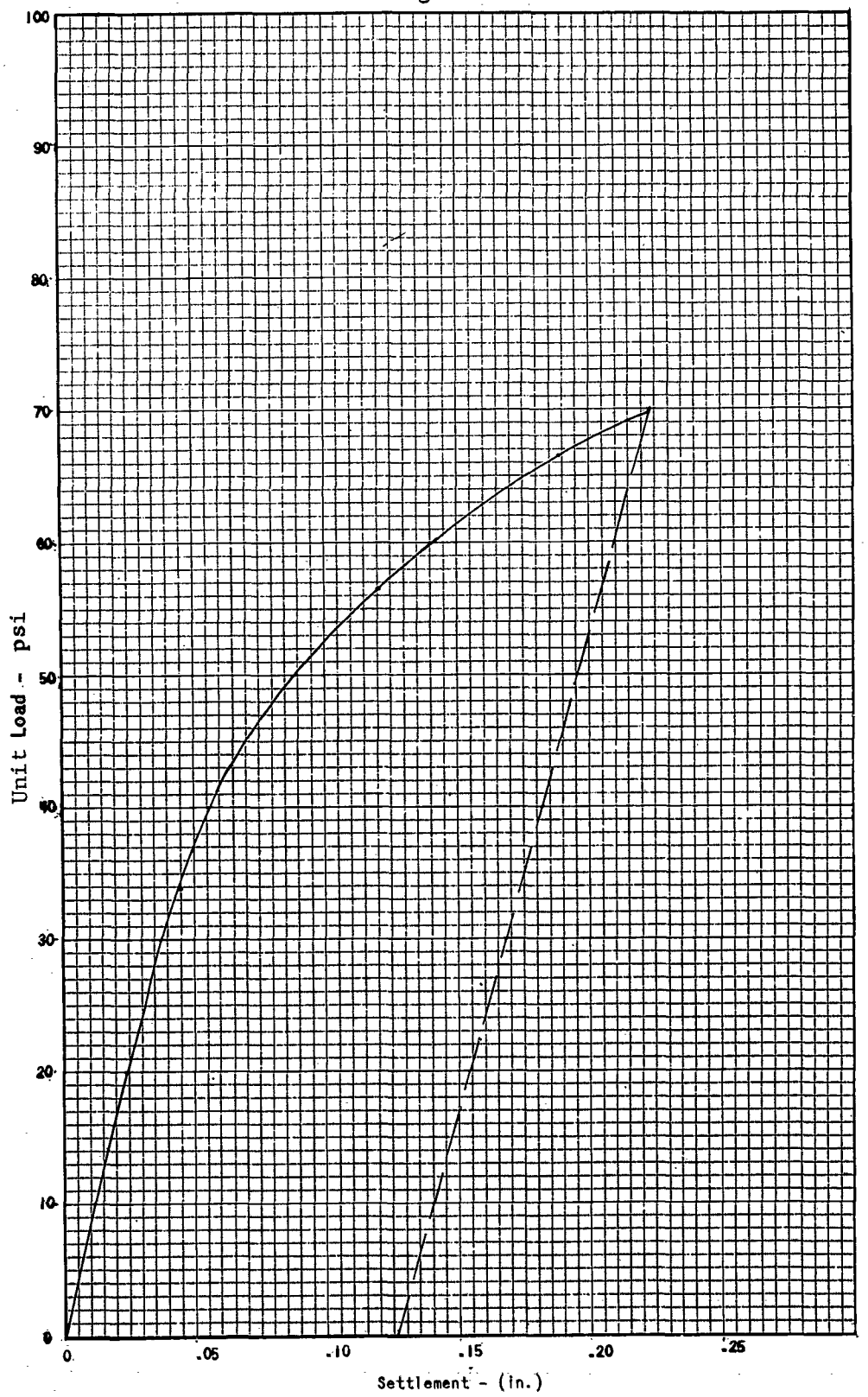


IIND NCEL 3960/20 (1-64)

UNIT LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Runway 03R-21L	93+50

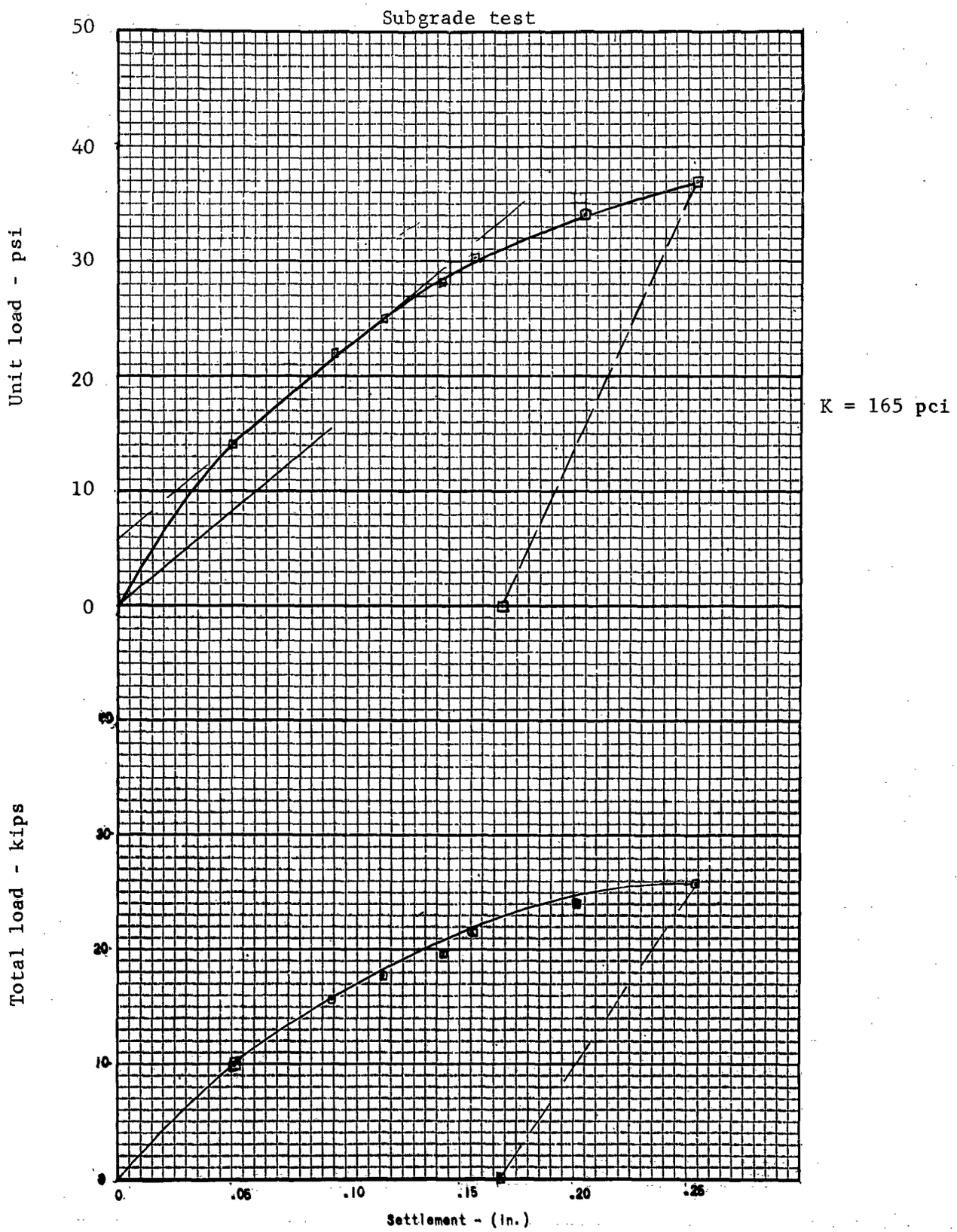
Subgrade Test



K = 740 pci

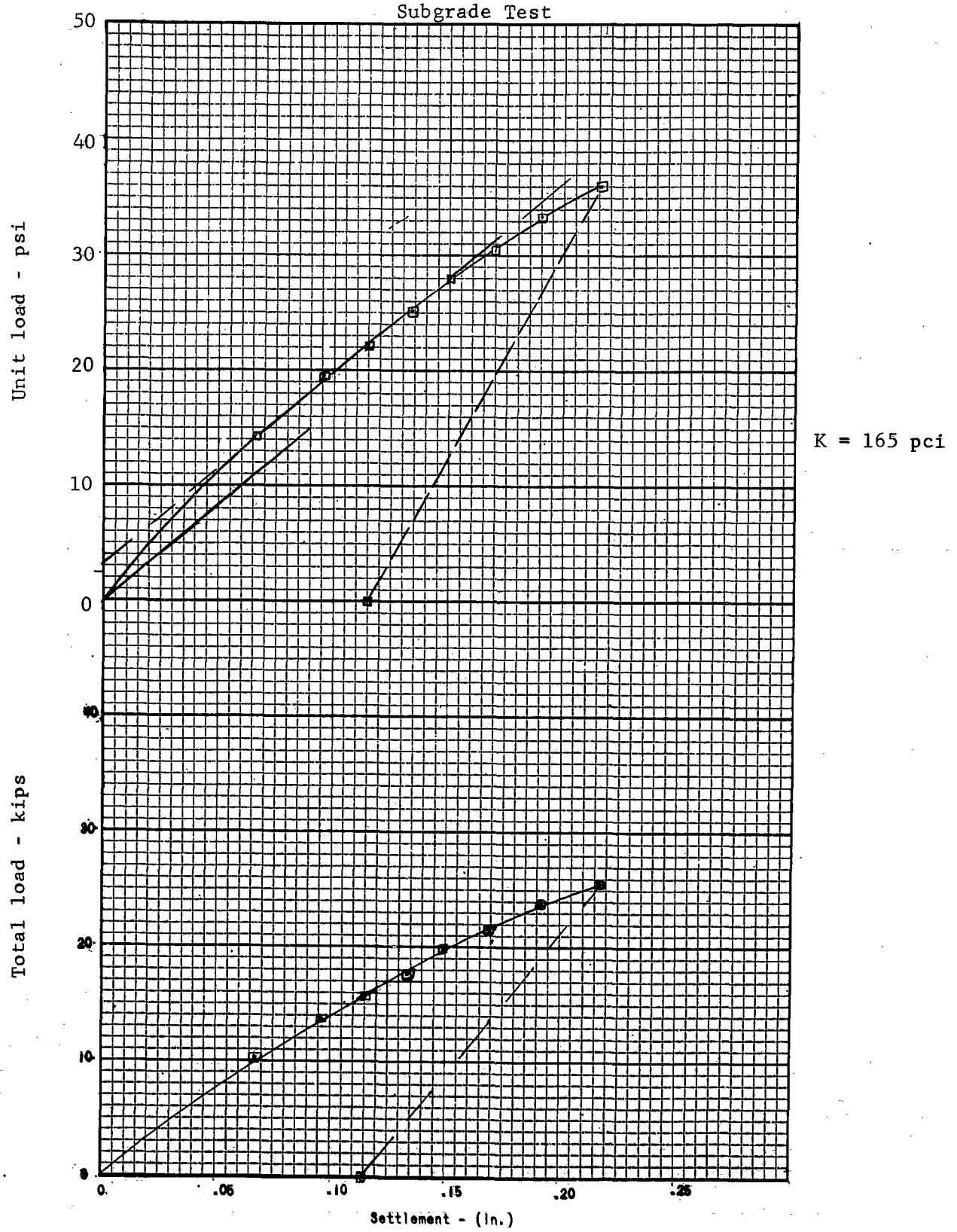
IIND NCEL 3960/20 (1-64) Unit & TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Operations Parking Apron	PA-1



IIND NCEL 3960/20 (1-64) Unit & TOTAL LOAD vs. DEFLECTION

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Operations Parking Apron	PA-2



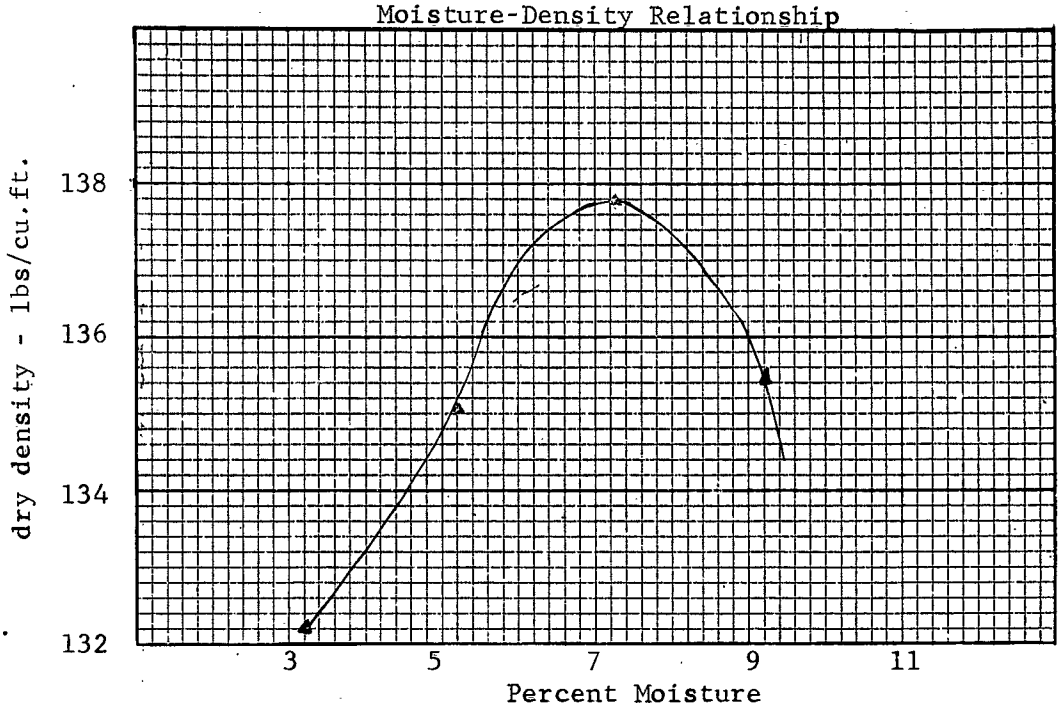
Appendix H

TYPICAL MOISTURE-DENSITY RELATIONSHIP

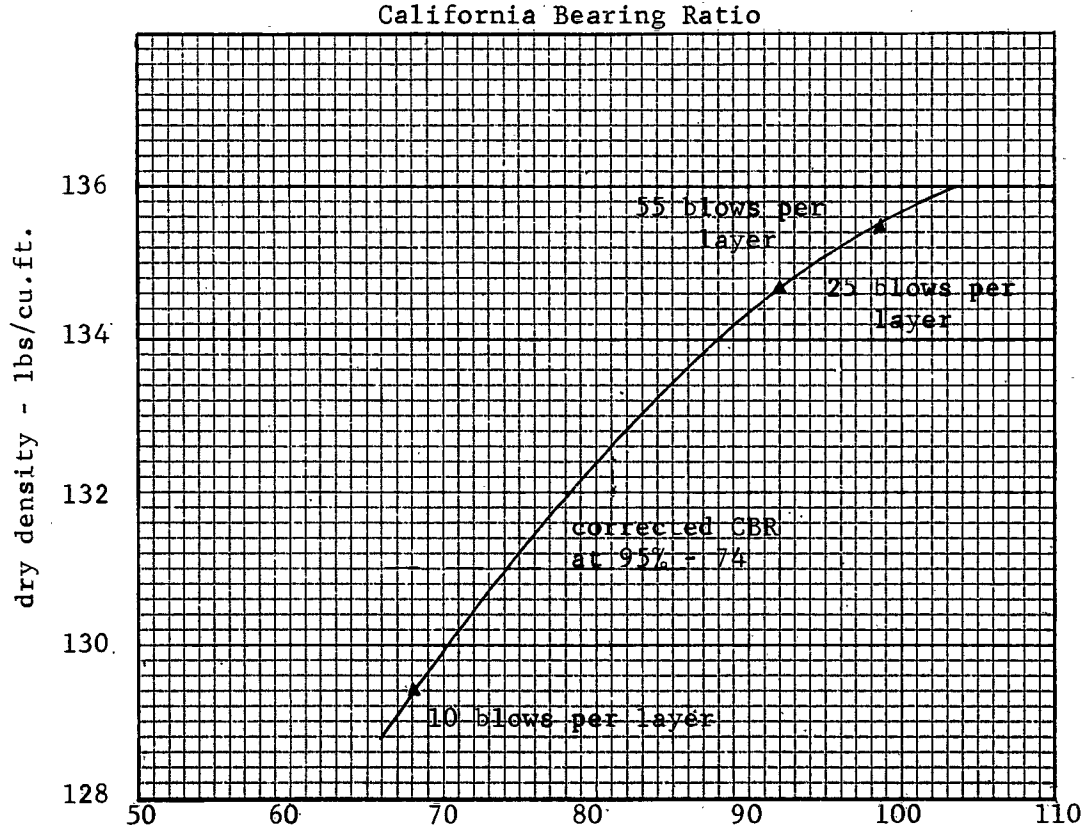
AND CALIFORNIA BEARING RATIO CURVES

FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	12+00 Base

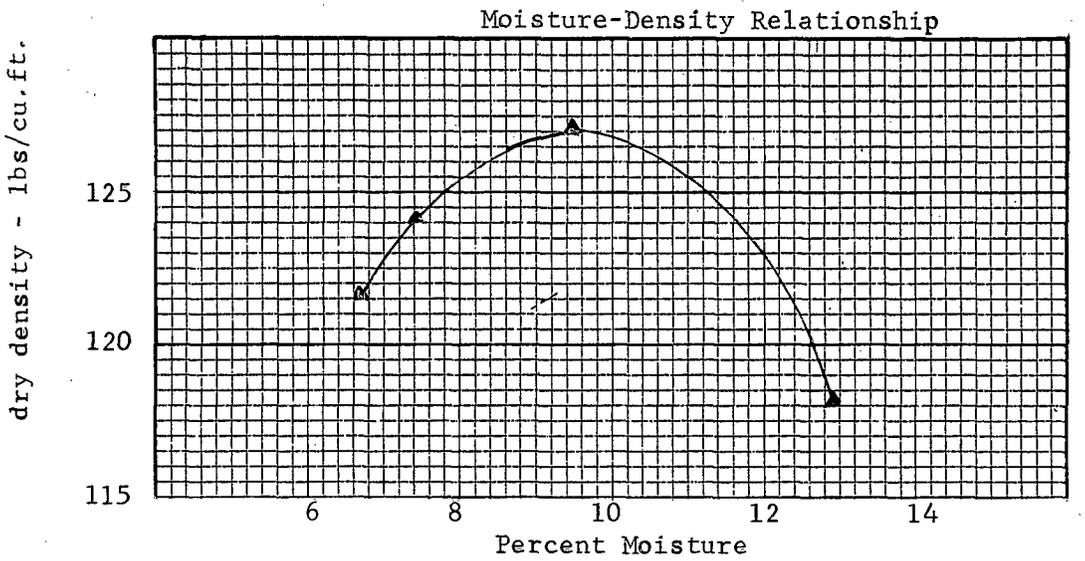
Moisture-Density Relationship

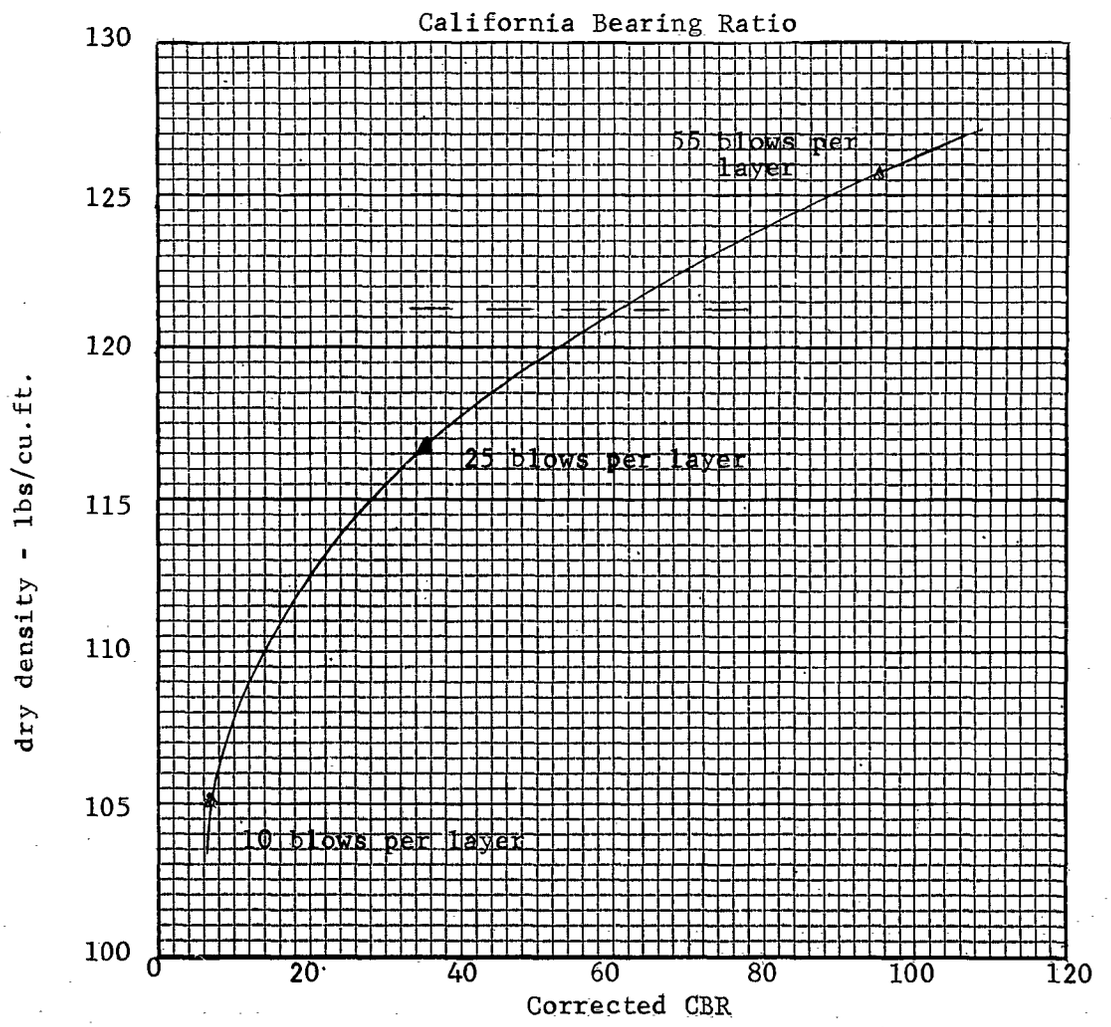


California Bearing Ratio



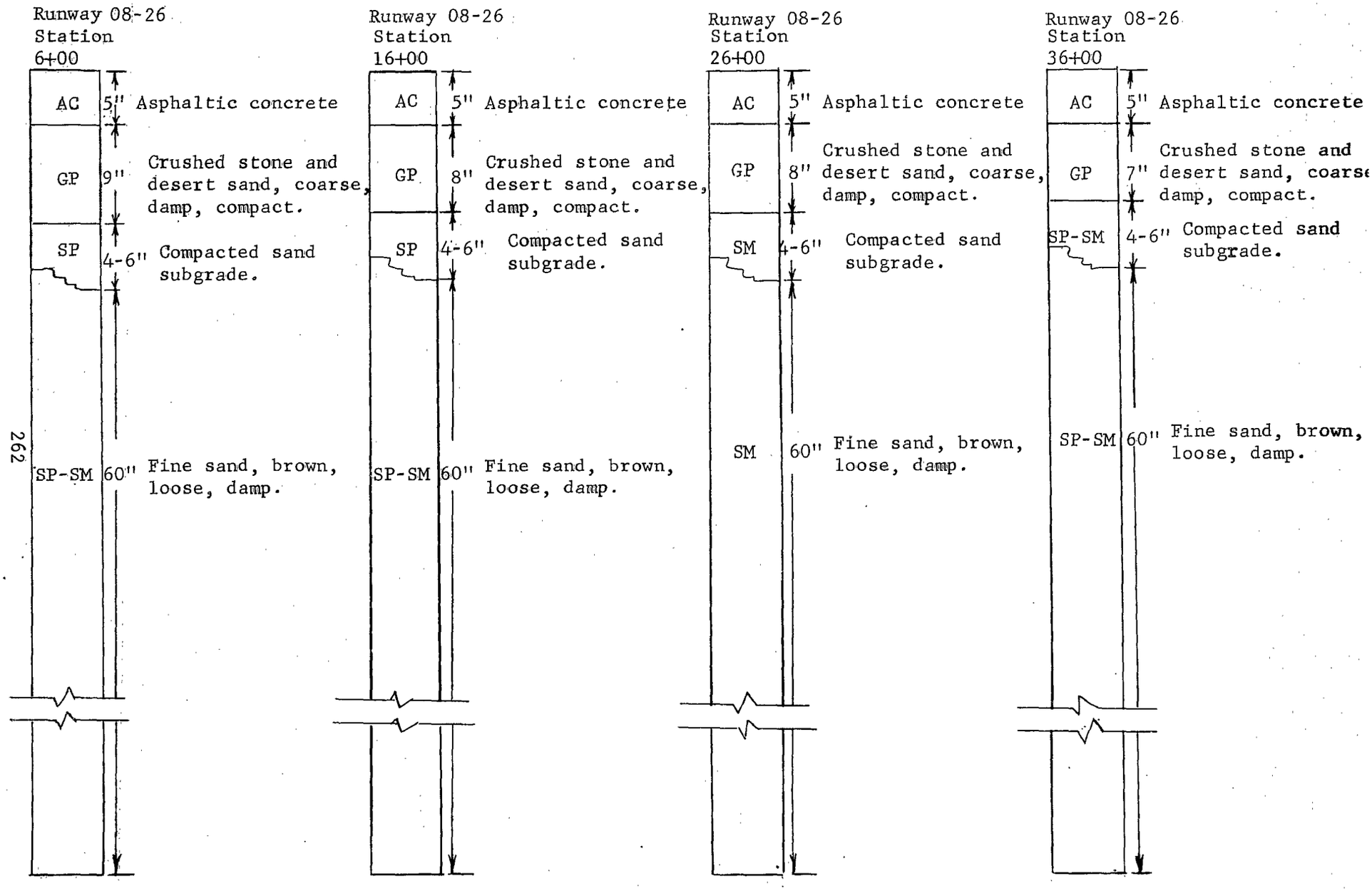
FACILITY	LOCATION	STATION
USMCAS Yuma, Arizona	Taxiway 1	41+00 Subgrade

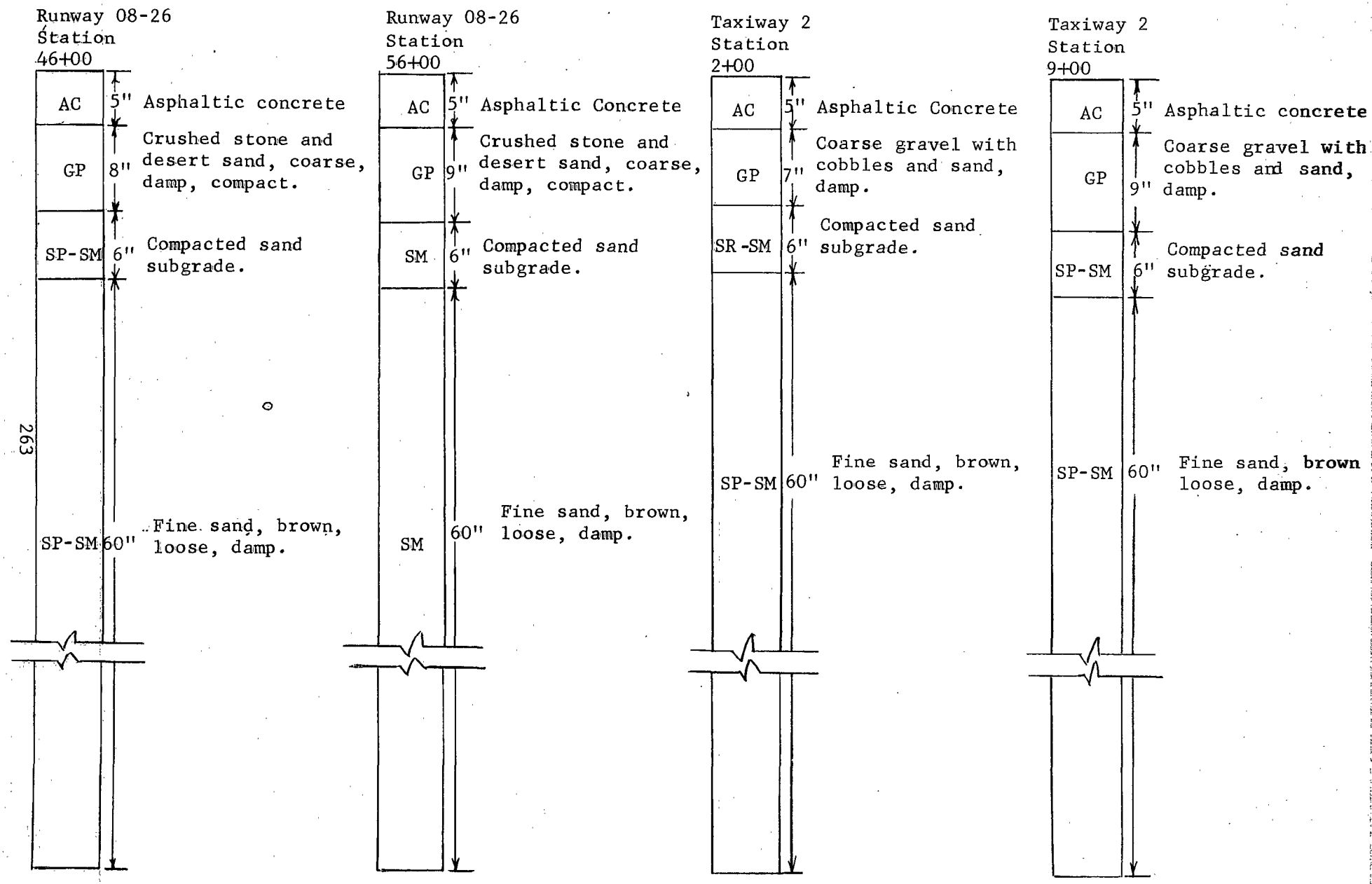


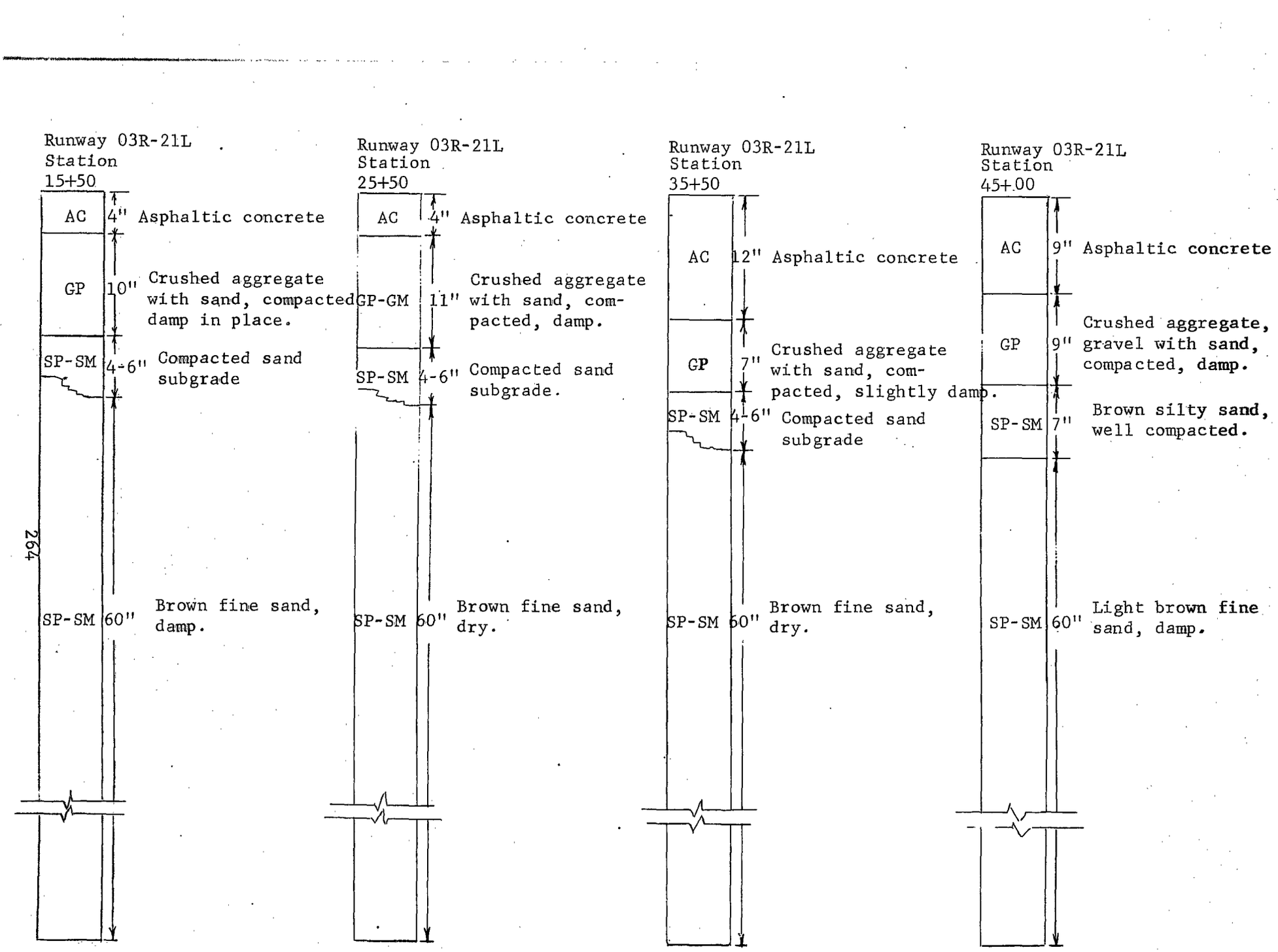


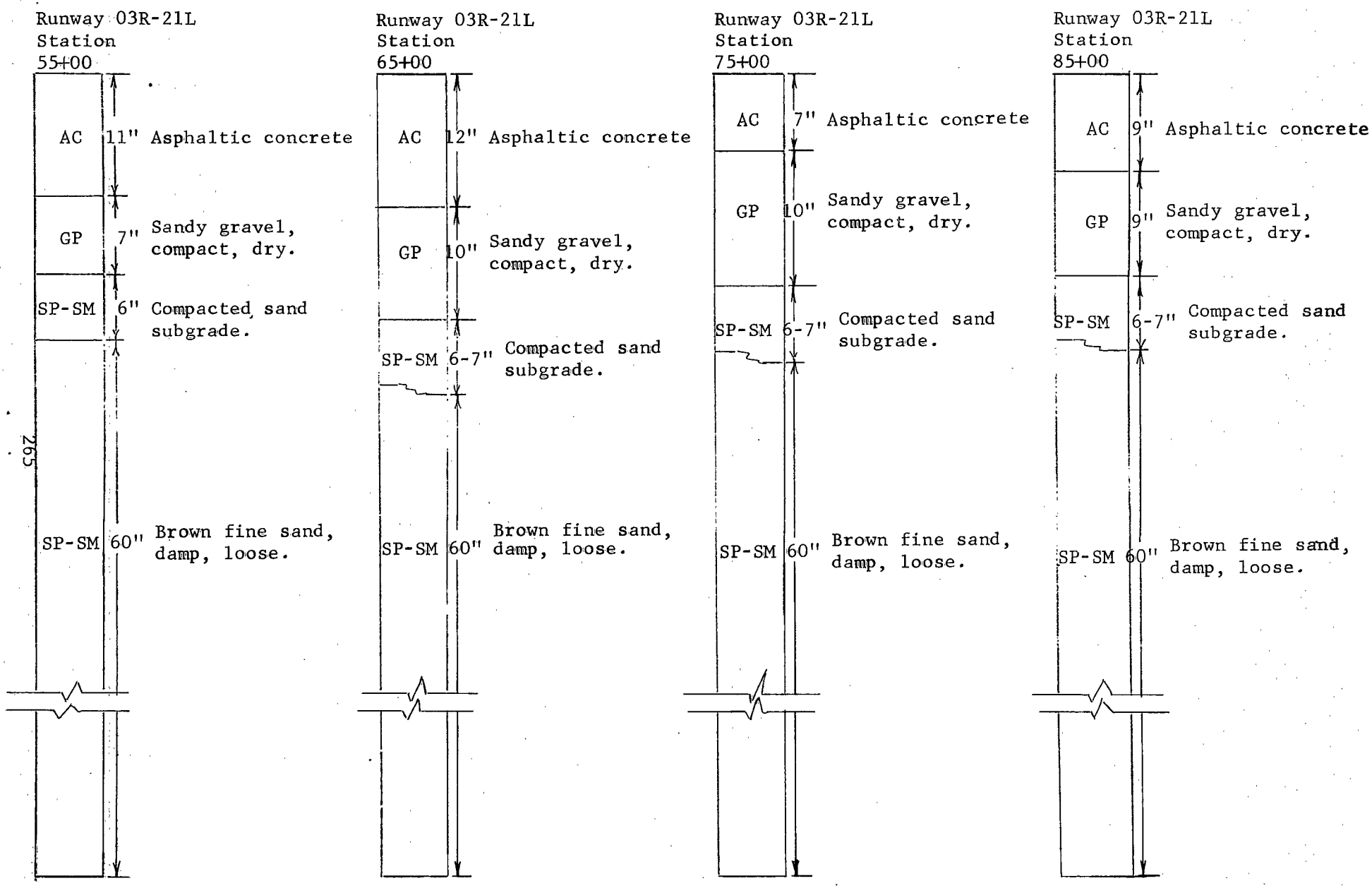
Appendix I

TEST PIT AND AUGER HOLE LOGS

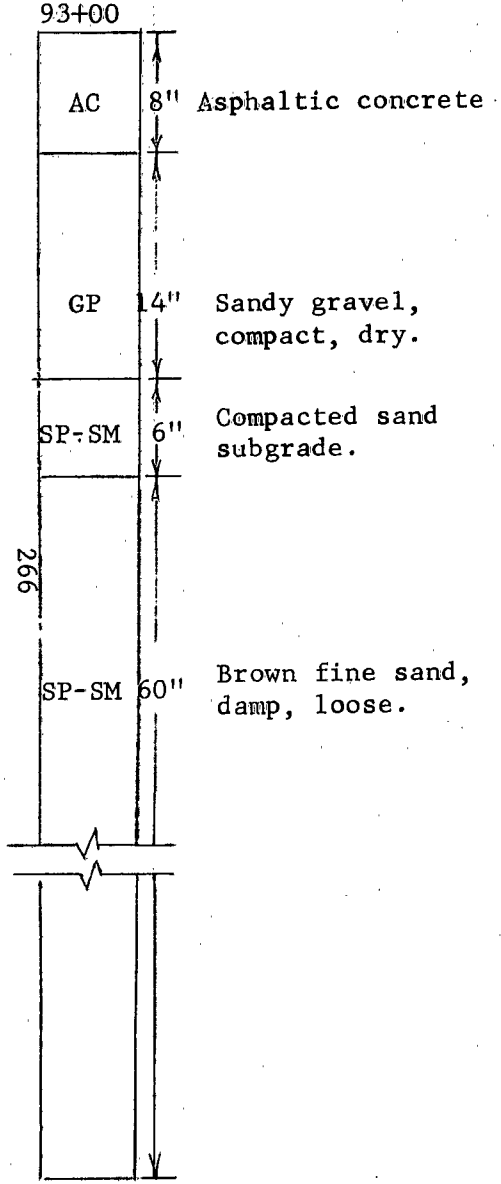

Runway 08-26
Station
6+00
AC
5"
Asphaltic concrete
GP
9"
Crushed stone and desert sand, coarse, damp, compact.
SP
4-6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown, loose, damp.
Runway 08-26
Station
16+00
AC
5"
Asphaltic concrete
GP
8"
Crushed stone and desert sand, coarse, damp, compact.
SP
4-6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown, loose, damp.
Runway 08-26
Station
26+00
AC
5"
Asphaltic concrete
GP
8"
Crushed stone and desert sand, coarse, damp, compact.
SM
4-6"
Compacted sand subgrade.
SM
60"
Fine sand, brown, loose, damp.
Runway 08-26
Station
36+00
AC
5"
Asphaltic concrete
GP
7"
Crushed stone and desert sand, coarse damp, compact.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown, loose, damp.


Runway 08-26
Station
46+00
AC
5"
Asphaltic concrete
GP
8"
Crushed stone and desert sand, coarse, damp, compact.
SP-SM
6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown, loose, damp.
Runway 08-26
Station
56+00
AC
5"
Asphaltic Concrete
GP
9"
Crushed stone and desert sand, coarse, damp, compact.
SM
6"
Compacted sand subgrade.
SM
60"
Fine sand, brown, loose, damp.
Taxiway 2
Station
2+00
AC
5"
Asphaltic Concrete
GP
7"
Coarse gravel with cobbles and sand, damp.
SR-SM
6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown, loose, damp.
Taxiway 2
Station
9+00
AC
5"
Asphaltic concrete
GP
9"
Coarse gravel with cobbles and sand, damp.
SP-SM
6"
Compacted sand subgrade.
SP-SM
60"
Fine sand, brown loose, damp.

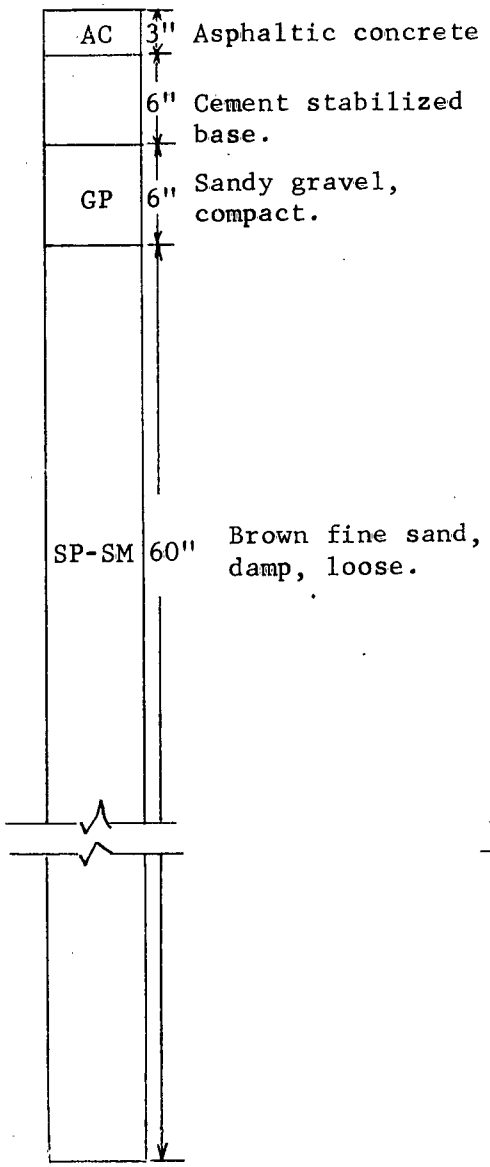

Runway 03R-21L
Station
15+50
AC
4" Asphaltic concrete
GP
10"
Crushed aggregate with sand, compacted damp in place.
SP-SM
4-6"
Compacted sand subgrade
SP-SM
60"
Brown fine sand, damp.
Runway 03R-21L
Station
25+50
AC
4" Asphaltic concrete
GP-GM
11"
Crushed aggregate with sand, compacted, damp.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, dry.
Runway 03R-21L
Station
35+50
AC
12" Asphaltic concrete
GP
7"
Crushed aggregate with sand, compacted, slightly damp.
SP-SM
4-6"
Compacted sand subgrade
SP-SM
60"
Brown fine sand, dry.
Runway 03R-21L
Station
45+00
AC
9" Asphaltic concrete
GP
9"
Crushed aggregate, gravel with sand, compacted, damp.
SP-SM
7"
Brown silty sand, well compacted.
SP-SM
60"
Light brown fine sand, damp.


Runway 03R-21L
Station
55+00
AC
11"
Asphaltic concrete
GP
7"
Sandy gravel, compact, dry.
SP-SM
6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.
Runway 03R-21L
Station
65+00
AC
12"
Asphaltic concrete
GP
10"
Sandy gravel, compact, dry.
SP-SM
6-7"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.
Runway 03R-21L
Station
75+00
AC
7"
Asphaltic concrete
GP
10"
Sandy gravel, compact, dry.
SP-SM
6-7"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.
Runway 03R-21L
Station
85+00
AC
9"
Asphaltic concrete
GP
9"
Sandy gravel, compact, dry.
SP-SM
6-7"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.

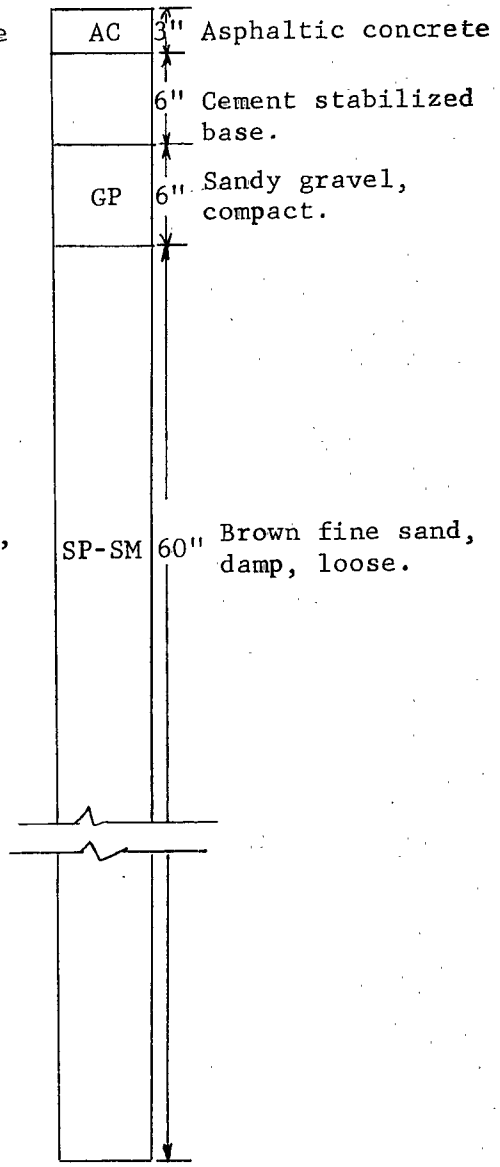
Runway 03R-21L
Station
93+00

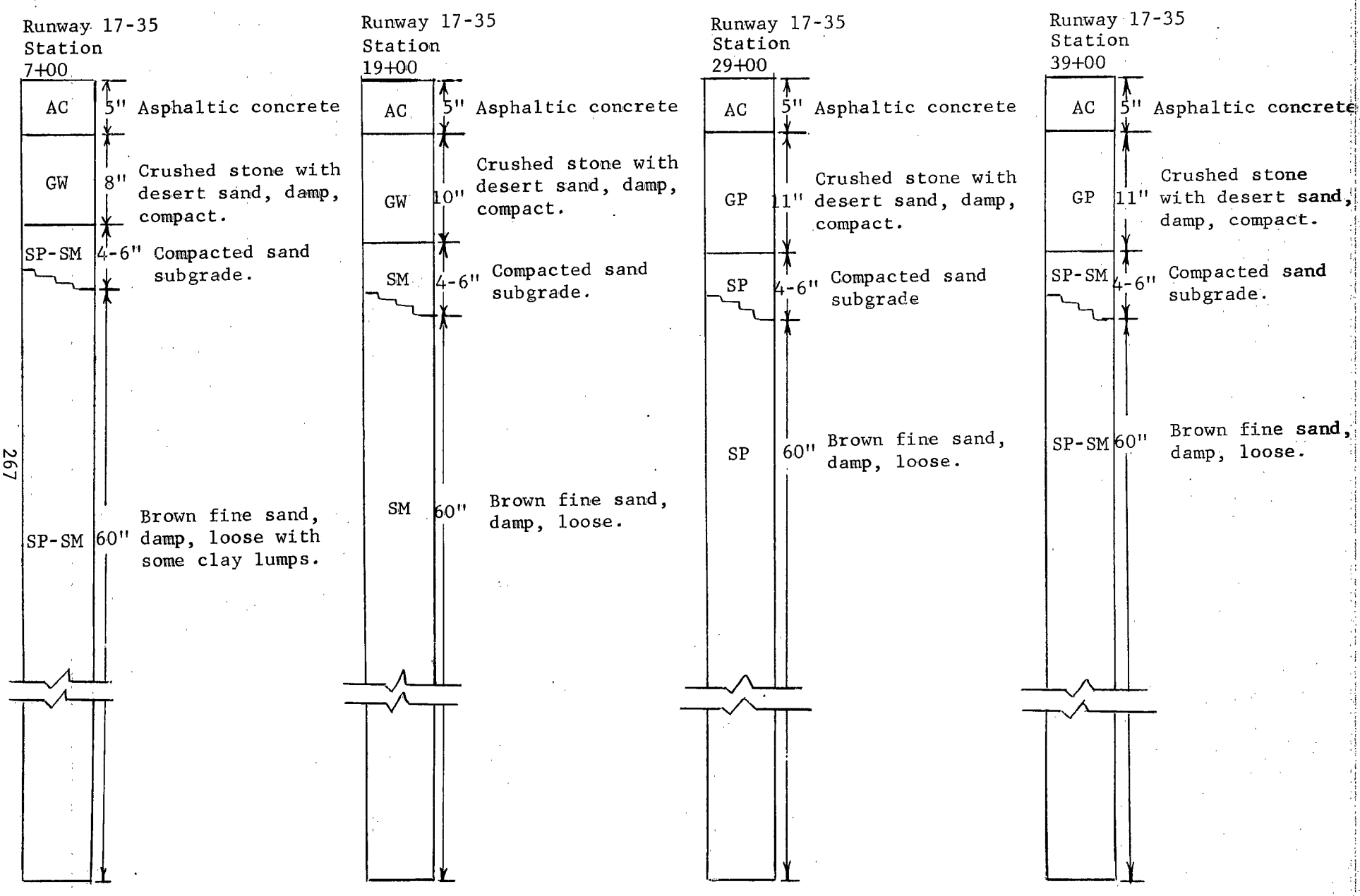


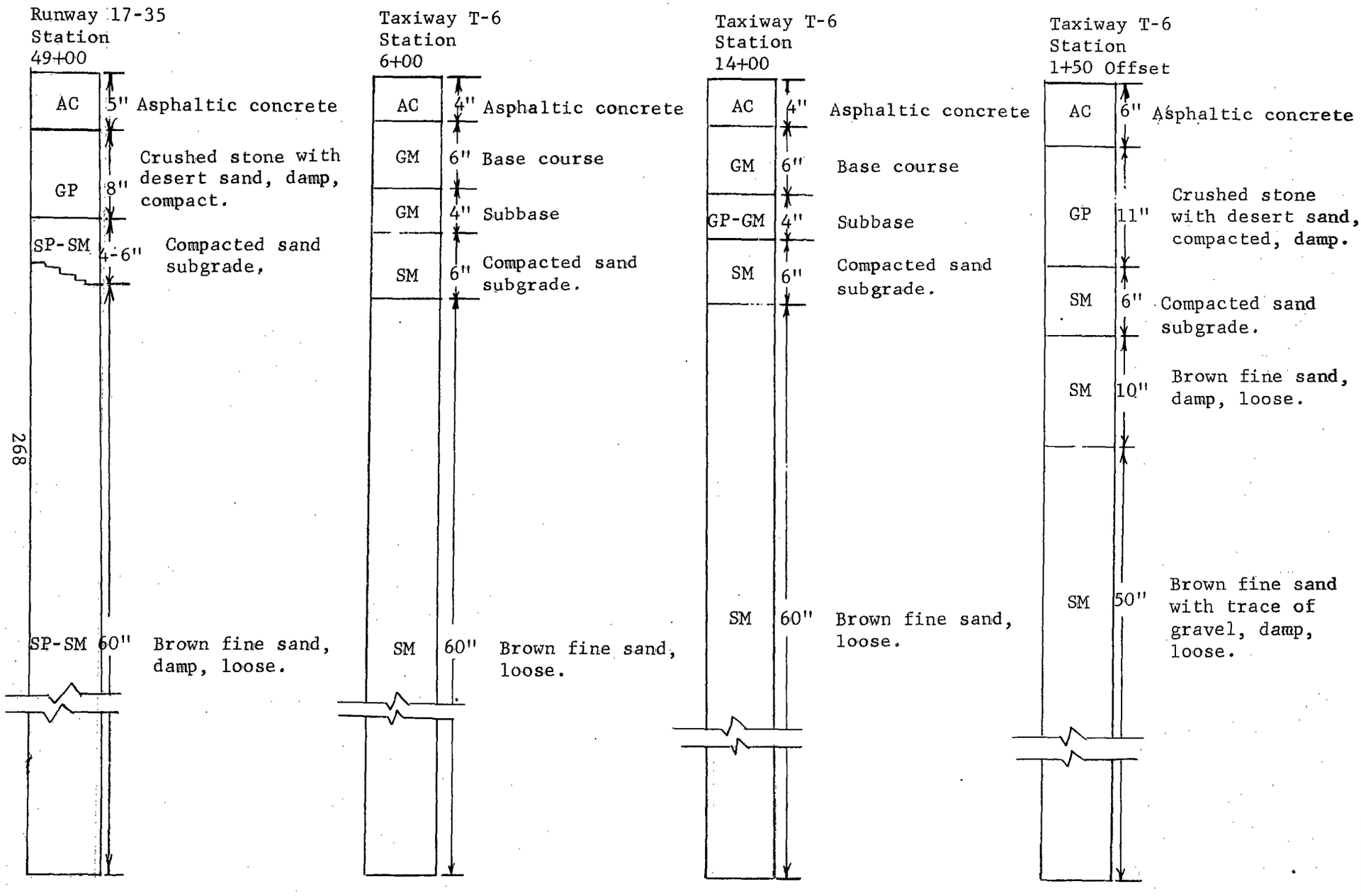
Taxiway 6-A
Station
6+00

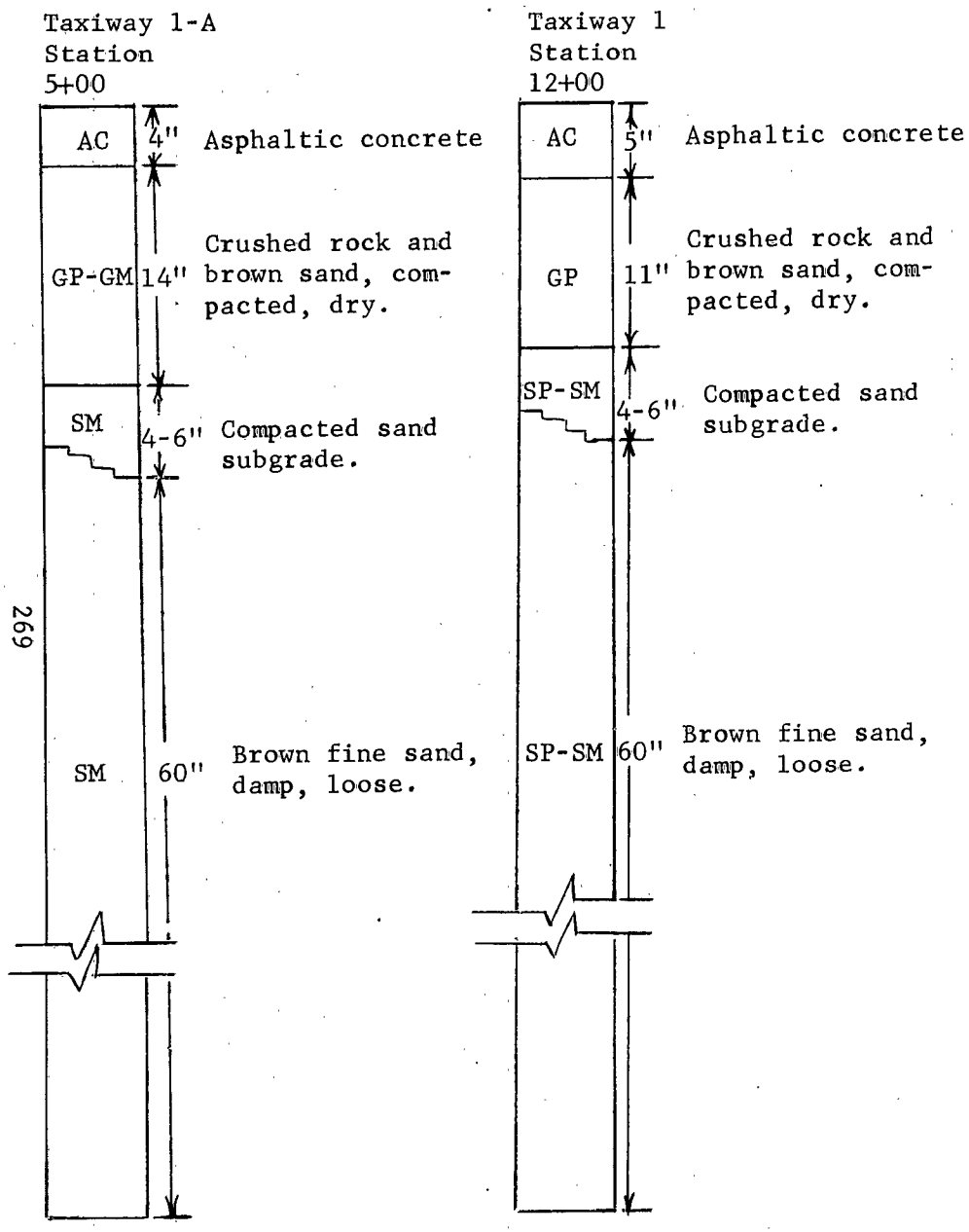


Taxiway 6-A
Station
16+00




Runway 17-35
Station
7+00
AC
5"
Asphaltic concrete
GW
8"
Crushed stone with desert sand, damp, compact.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose with some clay lumps.
Runway 17-35
Station
19+00
AC
5"
Asphaltic concrete
GW
10"
Crushed stone with desert sand, damp, compact.
SM
4-6"
Compacted sand subgrade.
SM
60"
Brown fine sand, damp, loose.
Runway 17-35
Station
29+00
AC
5"
Asphaltic concrete
GP
11"
Crushed stone with desert sand, damp, compact.
SP
4-6"
Compacted sand subgrade
SP
60"
Brown fine sand, damp, loose.
Runway 17-35
Station
39+00
AC
5"
Asphaltic concrete
GP
11"
Crushed stone with desert sand, damp, compact.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.


Runway 17-35
Station
49+00
AC
5" Asphaltic concrete
GP
8"
Crushed stone with desert sand, damp, compact.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.
Taxiway T-6
Station
6+00
AC
4" Asphaltic concrete
GM
6" Base course
GM
4" Subbase
SM
6"
Compacted sand subgrade.
SM
60"
Brown fine sand, loose.
Taxiway T-6
Station
14+00
AC
4" Asphaltic concrete
GM
6" Base course
GP-GM
4" Subbase
SM
6"
Compacted sand subgrade.
SM
60"
Brown fine sand, loose.
Taxiway T-6
Station
1+50 Offset
AC
6" Asphaltic concrete
GP
11"
Crushed stone with desert sand, compacted, damp.
SM
6"
Compacted sand subgrade.
SM
10"
Brown fine sand, damp, loose.
SM
50"
Brown fine sand with trace of gravel, damp, loose.


Taxiway 1-A
Station
5+00
AC
4"
Asphaltic concrete
GP-GM
14"
Crushed rock and brown sand, compacted, dry.
SM
4-6"
Compacted sand subgrade.
SM
60"
Brown fine sand, damp, loose.
Taxiway 1
Station
12+00
AC
5"
Asphaltic concrete
GP
11"
Crushed rock and brown sand, compacted, dry.
SP-SM
4-6"
Compacted sand subgrade.
SP-SM
60"
Brown fine sand, damp, loose.